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THIRD BIENNIAL REPORT
OF THE
VERMONT STATE BOARD
OF
AGRICULTURE,
Manufactures and Mining,
FOR THE YEARS 1875-76.

BY HENRY M. SEELY,
Secretary of the Board.

RUTLAND:
TUTTLE & COMPANY, PRINTERS AND PUBLISHERS.
1876.

MEMBERS OF THE BOARD

OF

Agriculture, Manufactures and Mining.

EX OFFICIIS.

His Excellency, ASAHEL PECK.

Rev. MATTHEW H. BUCKHAM, *Pres. State Ag. Coll.*

Professor PETER COLLIER, *Secretary of the Board.*

*HENRY M. SEELY, *Secretary of the Board.*

APPOINTED BY THE GOVERNOR AND SENATE.

Hon. THOMAS L. SHELDON, *Rupert.*

Hon. ALEXIS T. SMITH, *New Haven.*

Col. JOHN B. MEAD, *Randolph.*

Hon. C. HORACE HUBBARD, *Springfield.*

Hon. GARDNER S. FASSETT, *Enosburgh.*

CYRUS G. PRINGLE, Esq., *Charlotte.*

†JOHN H. MEAD, Esq., *West Rutland.*

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* Elected to the place of Prof. P. Collier, resigned.

† Appointed to the place of Hon. T. L. Sheldon, deceased.

MEMBERS OF FORMER BOARDS.

1871–1872.

His Excellency, JOHN W. STEWART.
JAMES B. ANGELL, *Pres. State Ag. Coll.*
PETER COLLIER, *Secretary of the Board.*
Hon. A. B. HALBERT, *Essex.*
Hon. CHARLES H. HEATH, *Plainfield.*
Hon. FREDERICK HOLBROOK, *Brattleboro.*
Hon. PITT W. HYDE, *Castleton.*
Z. E. JAMESON, Esq., *Irasburgh.*
Hon. NOAH B. SAFFORD, *White River Junction.*

1873–1874.

His Excellency, JULIUS CONVERSE.
Rev. MATTHEW H. BUCKHAM, *Pres. State Ag. Coll.*
PETER COLLIER, *Secretary of the Board.*
Hon. A. B. HALBERT, *Essex.*
Hon. CHARLES H. HEATH, *Montpelier.*
Hon. FRANCIS D. DOUGLAS, *Whiting.*
Hon. PITT W. HYDE, *Castleton.*
Z. E. JAMESON, Esq., *Irasburgh.*
THOMAS H. HOSKINS. M. D., *Newport.*

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REPORT.

To the Honorable, the General Assembly
of the State of Vermont:

Herewith is presented the Report of the Secretary of the Board of Agriculture, Manufactures and Mining for the biennium 1875–1876.

The work of the Board, as in years past, has consisted largely in holding public meetings, at which papers have been read, addresses made, and discussions held upon the topics presented.

Public meetings have been held at the following places:

In 1875.

At Middlebury, January 14 and 15.
At Springfield, January 26 and 27.
At Essex, January 28 and 29.
At Plainfield, February 9 and 10.
At St. Johnsbury, February 11 and 12.
At Jeffersonville, February 16 and 17.
At North Bennington, February 23 and 24.
At Clarendon, February 25 and 26.
At Wilmington, March 2 and 3.
At Bethel, March 4 and 5.

At East Berkshire, June 16 and 17.
At West Rutland, November 29 and 30.
At Ludlow, December 1 and 2.
At Canaan, December 7 and 8.
At Hinesburgh, December 22 and 23.
At Barre, December 28 and 29.
At Cabot, December 30 and 31.

In 1876.

At Irasburgh, January 11 and 12.
At Franklin, January 13 and 14.
At Brandon, January 17 and 18.
At Orwell, January 25 and 26.
At Fayetteville, February 1 and 2.
At Pomfret, February 3 and 4.
At Rochester, February 8 and 9.
At Chelsea, February 10 and 11.
At Bradford, February 15 and 16.
At Waitsfield, February 17 and 18.

The last series of meetings began at West Rutland, and is not yet complete, as it is in contemplation to continue the meetings after this date. A notice of these must be reserved until a subsequent report.

The Board has also held business meetings as follows:

At Montpelier, October 7, 1874.
At Burlington, December 10, 1874.
At Burlington, October 15, 1875.
At West Rutland, November 30, 1875.
At Barre, December 28, 1875.
At Pomfret, February 3, 1876.

Abstracts of the proceedings of these meetings will be found in their proper place.

The material interests of the State of Vermont are largely represented by those industries which the Board of Agriculture, Manufactures and Mining was created to assist. The majority of the older States of the Union years ago established, and have since sustained organizations similar in character or object to the existing Board in Vermont. The younger States, seeing the advantages of such organizations, have patterned after the older, and so have fostered the leading interests of their respective States. So long have those been tried and so valuable have they proved, that they have passed into the permanent institutions of the different States.

In the judgment of those who have given careful attention to the subject, the act of the Legislature calling the Board in Vermont into existence has proved a wise one. By the work of the Board the great pursuits of the people of the State have been encouraged.

The best method of arousing attention, securing co-operation, and conveying information was not quite clear at the first, but the experiment of holding meetings throughout the State for the discussion of practical topics has demonstrated this to be one great means of accomplishing the purposes had in view.

From the nature of the case the subjects discussed have been chiefly those allied to agriculture. The plan, though not accomplishing all that is contemplated, can now no longer be regarded as experimental; its value is established. The public meetings have been successful beyond all expectation. In several instances the halls for the sessions have been quite too small for the accommodation of those who have wished to attend. The discussions have for the most part been taken up with spirit and conducted with profit. The people have evinced an appreciation of the workof the Board and an increasing interest in the progress of ideas which tend to the advancement of the farmer's profession.

Reports of the proceedings of the various meetings, programmes of the public meetings, copies of as many papers as space will allow, and abstracts of the discussions are annexed to this Report.

The Board and the State have met with a great loss in the resignation of the former Secretary, Professor Peter Collier, who had laid so well the foundation of the agricultural work of the Board and under whose hand it had reached such a marked degree of success. His duties at the University and Agricultural College were thought to demand so much of his time, that he could not longer give his attention to the labor which the success of the Board imposed. His resignation taking effect November 30th, 1875, was accepted with regret.

The Board has continued a work which was entered upon early in the history of its establishment and which has been appreciated from the first, that of controlling as far as possible the character of the artificial fertilizers offered for sale within the bounds of the State. With the assistance of Professor Collier they have from time to time gathered these fertilizers and submitted them to chemical analysis. No better evidence of the wisdom of this course is needed than is afforded by the fact that the average of the fertilizers now offered in market is over thirty-three per cent. greater than when the first analyses were undertaken. These careful analyses by Professor Collier have been of more value than can well be estimated. The improvement in the character of these fertilizers is largely due to the scrutiny to which they have been subjected. Valueless, falsified, or deteriorated materials, rejected in other markets ought not to find sale here, and are not likely to be offered while they are subject to chemical inspection. The inducement to put upon the market an article of no value is largely removed, as the attempt to do so is liable to be detected at the outset. The oversight which the Board and similar bodies have exercised, has no doubt saved the country thousands and thousands of dollars that would otherwise have been sunk in the purchase of worthless articles.

By reference to the reports of the business meetings it will be seen that early in the year the Board authorized the Secretary to attempt the establishment of an Agricultural Experiment Station. These Stations have proved of so much value in Europe, and similar institutions have done such satisfactory work in our own country, that it has seemed exceedingly desirable that the State of Vermont, having industries somewhat peculiar to herself, should accept the advantages which such a station promises.

Many questions beyond the reach of the ordinary farmer need to be answered by accurate experiments. An Agricultural Experiment Station comes in to supplement the labor of the farmer and to determine the value of those theories and facts which promise great advantage to his profession.

The great industry of the State, dairy husbandry, cannot indeed be carried on, on a large scale, at an experiment station, but facts of vast importance can be determined there. Among such would be the temperature at which cream can be raised with the best results; the causes of the decomposition of butter and effectual means for preventing decomposition, with many of like character of prime importance to the butter maker. The cheese maker will be interested in the causes of the coagulation of milk and the best means of producing this coagulation; the changes that take place in the curing of cheese, and the means of hastening or retarding this change.

So questions will arise in every branch of agricultural pursuit; in grass raising, the introduction of new forage plants; in seeding the land, the genuineness, purity and vitality of seeds; in stock raising, food rations and the values of food; in purchasing fertilizers, their actual value. These are but samples of questions that may properly come under consideration at an agricultural station. To these may properly be added the work of collecting and distributing facts in the progress of agriculture, whether obtained from the field or from other agricultural stations.

With only fragments of time left over from a busy calling for such work and with a financial basis which pledges no expense to the Board or State, the results of the first few months' labor at the Vermont Station could not possibly be large. The collection of facts in regard to the fertilizers offered for sale within the State and their publication and distribution in the form of a bulletin, is all that has as yet been given to the public.

The action of the previous Board called the attention of the Legislature to a change which seemed desirable in the statute creating the Board. The framers of the act evidently contemplated the holding of one or two or at most a few yearly public meetings. In practice it is found desirable to hold just as many as the appropriation will allow. By reference to the list of public meetings it will be seen that already twenty-seven have been held since the present Board came into office. From twelve to fifteen will in all probability be held yearly.

The salary of the Secretary is now fixed without regard to the amount of work done, and under the act as it now stands the more meetings held, and consequently the more work done, the less net compensation he receives; he being required to attend these meetings at his own expense.

With such facts in view the recent Board presented the resolution, that in the opinion of the members, the statute creating the Board ought to be so amended that the Board may regulate the work and compensation of its Secretary, but in no case the entire expenses of said Board to exceed the stated appropriation.

These facts remain as weighty as ever and seem worthy the attention of the Legislature.

The present Secretary, coming as he did to his work at the middle of a term of service, could not possibly be fully conversant with the character of all the papers of which the Report is largely composed; and the early date of going to press forbids that careful editing and arrangement which he had proposed.

HENRY M. SEELY, *Secretary.*

Middlebury, July 25, 1876.

BUSINESS MEETINGS
OF THE
VERMONT STATE BOARD
OF
Agriculture, Manufactures and Mining.

ABSTRACTS FROM THE MINUTES.

EIGHTH BUSINESS MEETING.

This meeting was held at Montpelier, October 7th, 1874.

Present—Governor Converse, and Messrs. Heath, Douglas, Hyde, Halbert, Jameson and Hoskins.

The report proper of the Secretary, as prepared by the Secretary pro tem., was read and approved.

The records of the various meetings for the past two years were read and, after a single correction, approved for publication.

On motion, Hon. Pitt W. Hyde was requested to give his attention, in the legislature, to the amendment of the statute establishing the Board, and to other matters affecting this Board that may come before that body.

Mr. Jameson, to whom the collection of specimens of the grasses and cereals of Vermont had been assigned, was requested to forward a set of specimens to the State cabinet.

Adjourned sine die.

T. H. HOSKINS, *Secretary pro tem.*

NINTH BUSINESS MEETING.

Pursuant to the call of the Secretary, a meeting of the Board was held at the American Hotel, in the city of Burlington, Thursday, December 10th, at 7 p. m., 1874.

Governor Peck, President Buckham, the Secretary, and the newly appointed Board, viz.: Messrs. Mead, Hubbard, Sheldon, Smith, Pringle and Fassett, were present.

Mr. Sheldon moved that the Board proceed to the election of a Secretary. Carried.

On motion, it was decided to elect by ballot, and the Governor appointed Messrs. Mead and Sheldon as tellers.

Secretary Collier was re-elected to his office.

A general discussion was then held upon the work to be done by the Board, the best plan in holding the meetings, etc., and it was

Voted, That the system of local meetings at various points in the State as heretofore practiced by the Board be continued; that the Secretary be instructed to send slips to the press of the State containing a report of the organization of the Board, and inviting parties who desire to have meetings to communicate with the Secretary; and that the Secretary proceed as soon as may be to arrange the general programme of meetings for the winter and announce the same.

After a free discussion as to the number of meetings to be held during the winter, it was

Voted, That the Secretary appoint three meetings in the month of January, and that subsequent meetings be reserved for the further consideration of the Board.

Mr. Fassett expressed the desire of the farmers of Enosburgh that the Board should meet with them this winter.

Mr. Hubbard invited the Board to Springfield; and upon motion Springfield was designated as one of the places where a meeting should be held in January.

On motion, the meeting adjourned subject to the call of the Secretary.

PETER COLLIER, *Secretary.*

TENTH BUSINESS MEETING.

Pursuant to a call of the Secretary, a meeting of the Board was held at the American Hotel in Burlington, Friday, October 15th, at 7:30 p. m., 1875.

Every member of the Board was present except T. L. Sheldon.

There was a very full discussion of the work intrusted to the Board, as well as the best means of accomplishing the most favorable results.

It was voted, that two joint meetings be held with the New Hampshire Board, one in Vermont and one in New Hampshire, and that the Secretary be authorized to make arrangements for the same.

It was voted, that the number of meetings to be held this winter be left to the Secretary; and that he be directed to appoint as many as may be held by using and not exceeding the funds at the command of the Board.

It was voted, that abstracts of papers and reports of discussions at the public meetings be made, and such abstracts be furnished to the papers of the State.

It was voted, that the Secretary continue the analysis of fertilizers sold within the State.

Professor Collier tendered his resignation as Secretary of the Board, it being regarded necessary that all his time should be given to his lectures and work in the laboratory.

Several members of the Board expressed the hope that some way might be found out of this difficulty, so that the Board might retain Prof. Collier in its service.

President Buckham noticed the difficulties of the case:— that the duties of the Secretaryship so interfered with Prof. Collier's work that it really made it necessary to employ extra instruction in Chemistry. He thought, however, that Professor Collier might be permitted to be absent from his college work from December 22d to January 27th, and still continue in the employ of the Board as Secretary.

A resolution was proposed and adopted: That the work intrusted to us will not justify the Board in accepting the limitations to the services of the Secretary, as proposed by President Buckham.

Secretary Collier's resignation was accepted to take effect November 30th, 1875, and the following resolutions were adopted:

Resolved, That in accepting the resignation of Secretary Collier, the Board desires to express our approbation of the ability and zeal which he has brought to the discharge of the important duties of the office, and the confidence which the Board and people of Vermont entertain in his work.

Resolved, That it is our hope that in severing his official relations with the Board, Professor Collier will continue to co-operate, so far as he may be able, with the Board and the people of the State as heretofore, for the promotion of the agricultural interests of Vermont.

Professor Henry M. Seely was nominated as Secretary, and unanimously elected.

PETER COLLIER, *Secretary*.

ELEVENTH BUSINESS MEETING.

At a meeting called by Secretary Collier at West Rutland, Thursday, November 29th, at 6:30 p. m., 1875, there were present Messrs. Buckham, Mead, Hubbard, Smith and Pringle.

Governor Peck being absent, President Buckham was appointed Chairman pro tem. Secretary Collier was also absent, and H. M. Seely was appointed Secretary pro tempore.

On motion of Col. Mead, Mr. Hubbard was appointed to draft resolutions expressive of the feelings of the members of the Board at the death of their late colleague, Hon. Thomas L. Sheldon of Rupert.

On motion, proposed changes of time in holding some of the public meetings of the Board, was referred to Mr. Hubbard and the Secretary elect.

Subsequently the following resolutions were reported, and were adopted by the meeting:

Whereas, It has pleased Divine Providence to remove from life, by a sudden casualty, our late associate, Thomas L. Sheldon, therefore, it is

Resolved, That in the death of Mr. Sheldon we mourn the loss of one from whom we expected valuable assistance in the work of the Board.

Resolved, That our condolence and sympathy be extended to the family of Mr. Sheldon in their irreparable bereavement.

Resolved, That the Secretary forward copies of these resolutions to the family of Mr. Sheldon, and furnish them to the papers of the State.

HENRY M. SEELY, *Secretary pro tem.*

* * *

TWELFTH BUSINESS MEETING.

In accordance with the call of the Secretary, a business meeting was held at Barre, Tuesday, December 28th, at 4:30 p. m., 1875.

Present, all the members of the Board except Governor Peck, to wit: Messrs. Buckham, Fassett, Hubbard, J. B. Mead, Pringle, Smith, Seely and J. H. Mead, the latter gentleman having been recently appointed by the Governor to fill the vacancy caused by the death of Thomas L. Sheldon.

The object of the calling of the meeting was stated by the Secretary: that of making some provision, in accordance with the desire of the State Auditor, for the inspection and approval of the bills of the Secretary.

It was suggested that a pro tempore Chairman might be elected by the Board, who should be directed to perform this service.

On motion of A. T. Smith, Mr. G. S. Fassett was appointed Chairman pro tempore, and authorized to pass upon the Secretary's bills.

The Board then adjourned.

HENRY M. SEELY, *Secretary.*

THIRTEENTH BUSINFSS MEETING.

At the call of the Secretary, a meeting was held at Pomfret, February 3d, 1876, at which the following members were present, viz.: Messrs. Fassett, Hubbard, J. B. Mead, J. H. Mead, Pringle, Smith and Seely. Mr. Fassett, previously elected President pro tempore, took the chair.

In accordance with the notice in the call, the Secretary presented his views on the feasibility of establishing an Experimental Station at Middlebury. After discussing these views, a committee was appointed to consider the matter further, and at an adjourned meeting the following report was made:

The committee appointed to consider the subject of an Experimental Station in Vermont have given to the subject the consideration which its importance demands, and unanimously recommend that the Vermont Board of Agriculture do establish the second Experimental Station on this continent; and we submit to the Board the following preamble and vote, the passage of which we recommend:

Whereas, There are many questions which need to be determined by accurate and careful experiments, and

Whereas, Professor Henry M. Seely of Middlebury has signified his willingness to give, without remuneration, a portion of his time to such investigations and experiments, therefore, it is

Voted, That the Vermont Board of Agriculture, Manufactures and Mining do establish the Vermont Experiment Station, to be under the control of this Board, and that the same be placed in the charge of Professor Henry M. Seely as superintendent.

Voted, That the superintendent be authorized to make, or cause to be made by others, such investigations and experiments as shall seem to him likely to simplify and explain the relations of science to agriculture, make additions to our knowledge and skill in the cultivation of the soil, and raising and care of stock, and protect us from fraud and imposition. Such investigations to be without expense to the Board or the State.

C. HORACE HUBBARD, *for Committee.*

The report was accepted and the votes unanimously passed.

HENRY M. SEELY, *Secretary.*

PUBLIC MEETINGS
OF THE
VERMONT STATE BOARD
OF
Agriculture, Manufactures and Mining.

Twenty-seven public meetings have been held at various points in the State by the Board since the appointment of the present members. Invitations have come from various agricultural associations and from individuals, and in accordance with these solicitations the two day meetings have been held. While the programmes have been widely varied, the form and purpose of the gatherings have been substantially the same. The people have felt that the meetings were their own; they have officered them from their own number, have entered into the exercises with spirit, and have taken up the discussions with an intelligence and an enthusiasm that has been most gratifying.

A general report of one meeting may characterize all.

If the Board has met for the first time with the farmers of the place, the first session usually opens with a small number, the second session is well attended, and from that time on the rooms are crowded. Regrets are expressed by the late comers that they did not earlier know the character of the meetings. All are interested to the close, which they unite in saying has come too soon, and with a hearty good will invite the Board to appoint another and an early meeting.

If a similar meeting has in some previous year been held in the place or the vicinity, the sessions are fully attended from the first, and closed with the same approval of the work of the Board.

The local newspapers have usually given full reports of these meetings and so a larger audience than that addressed by the speakers has been reached.

The meetings early in the year of 1875 were in a few instances held in a time of storm, which materially interfered with the attendance. But the series beginning November 29 suffered no interruption on account of weather, and the programme of every meeting was carried out with the exception of a single session, which at one of the meetings was omitted on account of a powerful storm.

The following programmes were presented at the various meetings, and departed from only so far as circumstances indicated convenience or improvement.

TWENTY-NINTH PUBLIC MEETING

HELD AT

Middlebury, Thursday and Friday, January 14th and 15th, 1875.

PROGRAMME.

THURSDAY AFTERNOON.

"The Work of the Board," C. Horace Hubbard, Springfield.

"Hybridization of Cereals," C. G. Pringle, Charlotte.

THURSDAY EVENING.

"Opportunities of Farm Life in Vermont," President M. H. Buckham, Burlington.

FRIDAY MORNING.

"The Butter Dairy," G. S. Fassett, Enosburgh.

"Potato Culture," A. Rand, Colchester.

FRIDAY AFTERNOON.

"Natural Laws and their Relation to the Farmer," F. D. Douglas, Whiting.

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THIRTIETH PUBLIC MEETING

HELD AT

Springfield, Tuesday and Wednesday, January 26th and 27th, 1875.

PROGRAMME.

TUESDAY AFTERNOON.

"Address of Welcome," C. Horace Hubbard, Springfield.

"Draining of Wet Lands," James R. Walker, Springfield.

TUESDAY EVENING.

"The Butter Dairy," Gardner S. Fassett, Enosburgh.

WEDNESDAY MORNING.

"Poultry Raising for Pleasure and Profit," John G. McKeen, South Acworth, N. H.

"The Grasses of Vermont," Cyrus G. Pringle, Charlotte.

WEDNESDAY AFTERNOON.

"Fruit Growing for Profit," Thomass F. Butterfield, Weathersfield.

WEDNESDAY EVENING.

"The Progress of American Cheese Manufacture," C. W. Mudgett, Weathersfield.

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THIRTY-FIRST PUBLIC MEETING

HELD AT

Essex, Thursday and Friday, January 28th and 29th, 1875.

PROGRAMME.

THURSDAY AFTERNOON.

"Address of Welcome."

"The Mistakes of Farmers," S. G. Butler, Essex.

THURSDAY EVENING.

"The Mission of Friends of Agriculture," Peter E. Pease, Burlington.

FRIDAY MORNING.

"Hybridization of Cereals," Cyrus G. Pringle, Charlotte.

"Potato Culture," A. Rand, Burlington.

FRIDAY AFTERNOON.

"Hygiene of the Farm," Dr. L. C. Butler, Essex.

"Fattening and Marketing Poultry," Edwin Andrews, Essex.

FRIDAY EVENING.

"Geology as Related to Agriculture," R. B. Lillie, Essex.

"The Original Vermont Plow," H. M. Seely, Middlebury.

THIRTY-SECOND PUBLIC MEETING

HELD AT

Plainfield, Tuesday and Wednesday, February 9*th and* 10*th*, 1875.

PROGRAMME.

TUESDAY AFTERNOON.

"Introductory and Welcome Address," Nathan Skinner, Plainfield.

"Education of the Farmer," Ira G. Stone, Plainfield.

"The Grasses of Vermont," Cyrus G. Pringle, Charlotte.

TUESDAY EVENING.

"The Breeds of Cattle Best Adapted to Vermont," Austin D. Arms, East Montpelier.

"Selection of Cattle for the Dairy," Gardner S. Fassett, Enosburgh.

WEDNESDAY MORNING.

"Poultry," Rev. S. S. Davis, North Montpelier.

"Sheep Husbandry," A. E. Kinney, Plainfield.

WEDNESDAY AFTERNOON.

"Manures," Asa George, East Calais.

"General Principles of Fertilization," Peter Collier, Burlington.

WEDNESDAY EVENING.

"Cheese," Joseph L. Coburn, East Montpelier.

"Food, Its Economical Relations," J. Edwin Hollister, North Montpelier.

THIRTY-THIRD PUBLIC MEETING

HELD AT

St. Johnsbury, Thursday and Friday, February 11*th and* 12*th*, 1875.

PROGRAMME.

THURSDAY AFTERNOON.

"Opening Address," J. R. Kinerton, Peacham.

"Life on the Farm in Northern Vermont Fifty Years Ago," Henry Blake, East Hardwick.

"The Advantages of Hard Times," G. R. Drew, North Danville.

THURSDAY EVENING.

"What Kind of Farming Pays?" James G. Hovey, St. Johnsbury.

"The Importance of System in Agriculture," F. V. Powers, Waterford.

FRIDAY MORNING.

"How to Make Farming Honorable and Pleasant," E. P. Allen, St. Johnsbury Center.

"Hybridization of Cereals," Cyrus G. Pringle, Charlotte.

FRIDAY AFTERNOON.

"Progress in Agriculture and Education," J. P. Foster, Barnet.

"Æsthetic Culture," J. W. Sanborn, Lyndonville.

FRIDAY EVENING.

"Selection of Dairy Cows," Gardner S. Fassett, Enosburgh.

"Principles of Butter Making," Francis D. Douglas, Whiting.

THIRTY-FOURTH PUBLIC MEETING

HELD AT

Jeffersonville, Tuesday and Wednesday, February 16*th and* 17*th*, 1875.

PROGRAMME.

TUESDAY AFTERNOON.

"Address of Welcome," Dr. R. L. Flagg, Jeffersonville.

"What Our Farmers Want," Henry Smilie, Cambridge.

"Does Farming Pay ?" William Melendy, Jeffersonville.

"Intelligent Enterprise Necessary to Success in Farming," Miss Carrie P. Carroll, Jeffersonville.

TUESDAY EVENING.

"The Pleasure and Profit of Bee Keeping," Julius G. Morse, Cambridge

"The Manufacture of Maple Sugar," Joel M. Wilcox, Jeffersonville.

"Fruit Growing in Northern Vermont," Harmon Morse, Cambridge.

WEDNESDAY MORNING.

"Swamp Lands and Muck," Truman G. Powell, Jeffersonville.

"The Grasses of Vermont," Cyrus G. Pringle, Charlotte.

"Address,"—Subject to be announced, L. G. Sherwin, Hyde Park.

WEDNESDAY AFTERNOON.

"Woman's Work," Mrs. C. M. Powell, Jeffersonville.

"English Farming," William S. Thorp, Morristown.

WEDNESDAY EVENING.

"Selection of Cows for the Dairy," Gardner S. Fassett, Enosburgh.

"Butter Making," Ira Hawley, Cambridge.

"Butter Dairying," George W. Powell, Cambridge.

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THIRTY-FIFTH PUBLIC MEETING

HELD AT

North Bennington, Tuesday and Wednesday, February 23*d and* 24*th*, 1875.

PROGRAMME.

TUESDAY AFTERNOON.

"The Valuable Minerals of Vermont," J. E. Manly, Rutland.

"Feeding and Fattening Sheep for Market," Henry Lane, Cornwall.

TUESDAY EVENING.

"The Mission of Friends of Agriculture," Peter E. Pease, Burlington.

"The Water Power of Vermont,—The Hope of the State," Henry Clark, Rutland.

WEDNESDAY MORNING.

"The Best Horses for Vermont Farmers," Albert Chapman, Middlebury.

"Breeding Farm Stock," C. Horace Hubbard, Springfield.

WEDNESDAY AFTERNOON.

"Hybridization of Cereals," Cyrus G. Pringle, Charlotte.

"The Original Vermont Plow," Henry M. Seely, Middlebury.

WEDNESDAY EVENING.

"Selection of Cows for the Dairy," Gardner S. Fassett, Enosburgh.

"The General Dairy Interest," Alexis T. Smith, New Haven.

* * *

THIRTY-SIXTH PUBLIC MEETING

HELD AT

Clarendon, Thursday and Friday, February 25*th and* 26*th*, 1875.

PROGRAMME.

THURSDAY AFTERNOON.

"Does Farming Pay?" C. Horace Hubbard, Springfield.

"The Original Vermont Plow," Henry M. Seely, Middlebury.

THURSDAY EVENING.

"Agricultural Education," Charles M. Bliss, Bennington.

"Farm Accounts," Albert Chapman, Middlebury.

FRIDAY MORNING.

"Fruit Growing in Western Vermont," Stephen Clemons, Rutland.

"Fructification and Fruit," James E. Crane, Bridport.

FRIDAY AFTERNOON.

"The Water Power of Vermont,—The Hope of the State," Henry Clark, Rutland.

"Grasses of Vermont," Cyrus G. Pringle, Charlotte.

FRIDAY EVENING.

"Sheep Husbandry," Edwin S. Stowell, Cornwall.

"The General Dairy Interest," Alexis T. Smith, New Haven.

* * *

THIRTY-SEVENTH PUBLIC MEETING

HELD AT

Wilmington, Tuesday and Wednesday, March 2d and 3d, 1875.

PROGRAMME.

TUESDAY AFTERNOON.

"Breeding Farm Stock," C. Horace Hubbard, Springfield.

TUESDAY EVENING.

"Agricultural Education," Charles M. Bliss, Bennington.

WEDNESDAY MORNING.

"The General Dairy Interest," Alexis T. Smith, New Haven.

"Manufacture of Butter," E. A. Fitch, Wilmington.

WEDNESDAY AFTERNOON.

"Making and Marketing Maple Sugar," A. Stone, Wilmington.

"Manufacture of Maple Sugar," E. A. Fitch, Wilmington.

WEDNESDAY EVENING.

"Fructification and Fruit," James E. Crane, Bridport.

"The Water Power of Vermont,—The Hope of the State," Henry Clark, Rutland.

THIRTY-EIGHTH PUBLIC MEETING

HELD AT

Bethel, Thursday and Friday, March 4th and 5th, 1875.

PROGRAMME.

THURSDAY AFTERNOON.

"Does Farming Pay?" Crosby Miller, Pomfret.

"Relation of Virtue to an Improved Agriculture," Rev. T. S. Hubbard, Rochester.

THURSDAY EVENING.

"The General Dairy Interest," A. T. Smith, New Haven.

"Breeding Farm Stock," Homer W. Vail, Pomfret.

FRIDAY MORNING.

"Agriculture at Large," M. A. Ballard, Gaysville.

"Barns and Farm Buildings," J. B. Mead, Randolph.

FRIDAY AFTERNOON.

"The Best Horses for Vermont Farmers," A. Chapman, Middlebury.

"The Trotting Horse, Shall he be admitted to our Agricultural Fairs?" W. C. Danforth, Barnard.

FRIDAY EVENING.

"The Ravages of Insects," J. C. McKenzie, Woodstock.

"Merino Sheep and Sheep Breeding," A. E. Perkins, Pomfret.

THIRTY-NINTH PUBLIC MEETING

HELD AT

East Berkshire, Wednesday and Thursday, June 16*th and* 17*th*, 1875.

PROGRAMME.

WEDNESDAY MORNING.

" Address of Welcome," Silas Hopkins, Enosburgh.

" Hybridization of Cereals," Cyrus G. Pringle, Charlotte.

WEDNESDAY AFTERNOON.

" The General Principles of Fertilization," Peter Collier, Burlington.

WEDNESDAY EVENING.

" Professional vs. Farm Life," A. P. Croft, West Enosburgh.

" The General Dairy Interest," Alexis P. Smith, New Haven.

THURSDAY MORNING.

" The Cost of Making a Pound of Butter," W. H. McAllister, West Enosburgh.

" Butter Making," R. C. Chaffee, Berkshire.

THURSDAY AFTERNOON.

" The Farmer's Table," Henry Hopkins, East Berkshire.

" Living on the Farm," Miss Edna Rice, Enosburgh.

" Farm Buildings," O. N. Kelton, Montgomery.

FORTIETH PUBLIC MEETING

HELD AT

West Rutland, Monday and Tuesday, November 29th and 30th, 1875.

PROGRAMME.

MONDAY AFTERNOON.

"Opening Address," J. E. Manley, West Rutland.

"Horses for Vermont," Albert Chapman, Middlebury.

"Vermont Minerals and the Forests of the State," L. B. Smith, West Rutland.

MONDAY EVENING.

"Waste on the Farm," C. Horace Hubbard, Springfield.

"Opportunities for Young Farmers," John B. Mead, Randolph.

TUESDAY MORNING.

"The Cultivation of the Mind and Soil," J. G. Griggs, West Rutland.

"The Potato Disease," Cyrus G. Pringle, Charlotte.

TUESDAY AFTERNOON.

"The Water Power of the State," Henry Clark, Rutland.

"Sheep Breeding," John H. Mead, West Rutland.

TUESDAY EVENING.

"The General Interests of the Dairy," Alexis T. Smith, New Haven.

"The Selection and Care of Cows for the Dairy," Gardner S. Fassett, Enosburgh.

FORTY-FIRST PUBLIC MEETING

HELD AT

Ludlow, Wednesday and Thursday, December 1st and 2d, 1875.

PROGRAMME.

WEDNESDAY AFTERNOON.

"Address of Welcome," L. G. Fullam, Ludlow.

"Horses for Vermont," Albert Chapman, Middlebury.

"Water Power of Vermont," Henry Clark, Rutland.

WEDNESDAY EVENING.

"Does Farming Pay Equal to the Professions?" A. F. Hubbard, Tyson Furnace.

"Opportunities for Young Farmers," John B. Mead, Randolph.

THURSDAY MORNING.

"What Are the Serious and Common Impediments that Hinder the Prosperity of the Farmer?" Ex-Gov. Ryland Fletcher, Cavendish.

"Waste on the Farm," C. Horace Hubbard, Springfield.

THURSDAY AFTERNOON.

"The Principles of Fertilization," J. W. Stickney, Tyson Furnace.

"Does Land Leach?" L. F. Wheeler, Ludlow.

THURSDAY EVENING.

"The General Dairy Interest," Alexis T. Smith, New Haven.

"The Setting of Milk," L. G. Fullam, Ludlow.

"The Selection and Care of Cows for the Butter Dairy," Gardner S. Fassett, Enosburgh.

FORTY-SECOND PUBLIC MEETING

HELD IN CONNECTION WITH

THE NEW HAMPSHIRE BOARD OF AGRICULTURE

At Canaan, Tuesday and Wednesday, December 7th and 8th, 1875.

PROGRAMME.

TUESDAY AFTERNOON.

"Training Animals," C. Horace Hubbard, Member Vermont Board.

"Neat Stock," S. W. Buffum, Member New Hampshire Board.

"Cattle Raising," C. P. Judd, Canaan.

TUESDAY EVENING.

"Work and Wages," Silas Hopkins, East Berkshire.

"Relation of Science to Agriculture," Prof. Henry M. Seely, Secretary Vermont Board.

"Review of New Hampshire Farming," J. O. Adams, Secretary New Hampshire Board.

WEDNESDAY MORNING.

"Butter Making," G. S. Fassett, Member Vermont Board.

"Grasses," J. W. Sanborn, Member New Hampshire Board.

"Tilling the Soil," G. W. Hartshorn, Canaan.

WEDNESDAY AFTERNOON.

"Sheep Husbandry," Dr. Kingsbury, Member New Hampshire Board.

"Potato Culture," C. G. Pringle, Member Vermont Board.

"Opportunities for Young Farmers," Col. Mead, Member Vermont Board.

FORTY-THIRD PUBLIC MEETING

HELD AT

Hinesburgh, Wednesday and Thursday, December 22d and 23d, 1875.

PROGRAMME.

WEDNESDAY AFTERNOON.

"The Potato Disease," C. G. Pringle, Charlotte.

"The Potato and Its Culture," A. Rand, Burlington.

WEDNESDAY EVENING.

"The Bright Side of Farm Life," Rev. L. B. Hibbard, Charlotte.

"Relation of Science to Agriculture," H. M. Seely, Middlebury.

THURSDAY MORNING.

"Horses for Vermont," Albert Chapman, Middlebury.

"Mixed Farming," C. Horace Hubbard, Springfield.

THURSDAY AFTERNOON.

"Shell Marl a Fertilizer," Henry Miles, Monkton.

"Physiological Culture," Dr. H. D. Hodge, Charlotte.

"Cranberry Culture," M. H. Hosford, Charlotte.

THURSDAY EVENING.

"Selection of Dairy Cows," G. S. Fassett, Enosburgh.

"General Dairy Interest," A. T. Smith, New Haven.

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FORTY-FOURTH PUBLIC MEETING

HELD AT

Barre, Tuesday and Wednesday, December 28th and 29th, 1875.

PROGRAMME.

TUESDAY MORNING.

"Opening Address," Eli Holden, Barre.

"The Potato Disease," C. G. Pringle, Charlotte.

"The Potato and its Culture," A. Rand, Burlington.

TUESDAY AFTERNOON.

"Noxious Insects," Prof. G. H. Perkins, Burlington.

"Agricultural Experiment Stations," Prof. W. O. Atwater, Middletown, Conn.

TUESDAY EVENING.

"Farm Buildings," J. B. Mead, Randolph.

"The Original Vermont Plow," H. M. Seely, Middlebury.

WEDNESDAY MORNING.

"Selection of Dairy Cows," G. S. Fassett, Enosburgh.

"General Dairy Interest," A. T. Smith, New Haven.

WEDNESDAY AFTERNOON.

"Increasing the Grass Crop," N. Skinner, Plainfield.

"Horticulture and its Benefits," E. E. Andrews, Berlin.

WEDNESDAY EVENING.

"What will make Farming more Desirable?" D. B. Wheelock, Barre.

"How to Educate the Laborer," Dr. J. S. Spaulding, Barre.

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FORTY-FIFTH PUBLIC MEETING

HELD AT

Cabot, Thursday and Friday, December 30th and 31st, 1875.

PROGRAMME.

THURSDAY AFTERNOON.

"Words at the Start," Chairman.

"Do Something," Miss Dora M. White, Washington.

"Sanitary Reform," Dr. L. S. Wiswell, Cabot.

THURSDAY EVENING.

"Wants and Needs of the Farmer," L. W. Pitkin, Marshfield.

"Leaves," H. M. Seely, Middlebury.

FRIDAY MORNING.

"The Potato Disease," C. G. Pringle, Charlotte.

"Farm Drainage," A. O. Cummings, Montpelier.

"Root Crops," J. K. Tobey, Calais.

FRIDAY AFTERNOON.

"Neat Stock," L. C. Fisher, Cabot.

"Selection of Dairy Cows," G. S. Fassett, Enosburgh.

"General Dairy Interest," A. T. Smith, New Haven.

FRIDAY EVENING.

"Sugar Making," S. H. Foster, Calais.

"Opportunities for Young Farmers," J. B. Mead, Randolph.

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FORTY-SIXTH PUBLIC MEETING

HELD AT

Irasburgh, Tuesday and Wednesday, January 11*th and* 12*th*, 1876.

PROGRAMME.

TUESDAY MORNING.

"The Year Round," Z. E. Jameson, Irasburgh.

"Winter Care of Stock," C. Horace Hubbard, Springfield.

TUESDAY AFTERNOON.

"Breeding of Stock," Dr. Geo. A. Hinman, Charleston.

"Education for Farmers' Boys," Dr. T. H. Hoskins, Newport.

TUESDAY EVENING.

"The Work for our Schools of Learning," Pres. C. B Hulbert, Middlebury.

WEDNESDAY MORNING.

"Southern Agriculture," E. P. Colton, Irasburgh.

"Grasses," C. G. Pringle, Charlotte.

WEDNESDAY AFTERNOON.

"Butter Making," G. S. Fassett, Enosburgh.

"Management of the Dairy," Thomas Baker, Barton.

"General Dairy Interest," A. T. Smith, New Haven.

WEDNESDAY EVENING.

"White Mountains," Dr. H. A. Cutting, Lunenburgh.

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FORTY-SEVENTH PUBLIC MEETING

HELD AT

Franklin, Thursday and Friday, January 13*th and* 14*th*, 1876.

PROGRAMME.

THURSDAY MORNING.

"Opening Address," Hon. J. P. Olds, Franklin.

"How to Make Farming Pay," O. G. Start, Bakersfield.

"Feeding Grain to Stock," H. E. Cleaveland, Franklin.

THURSDAY AFTERNOON.

"Does Ignorance Pay?" Mrs. Kittie Bell, Franklin.

"Farm Buildings," J. B. Mead, Randolph.

"The Dairy Interest," A. T. Smith, New Haven.

THURSDAY EVENING.

"(Subject unannounced)," Miss Mary A. Pomeroy, Franklin.

"Education for Farmers' Boys," Dr. T. H. Hoskins, Newport.

FRIDAY MORNING.

"Improvement in Farming Implements and Machines," J. T. Hefflon, Franklin.

"The Potato," Z. E. Jameson, Irasburgh.

FRIDAY AFTERNOON.

"Winter Care of Stock," C. Horace Hubbard, Springfield.

"Manufacturing Interests," C. H. Heath, Montpelier.

FRIDAY EVENING.

"Capital in Farming," E. R. Towle, West Berkshire.

"The Soil We Cultivate," John Webster, Franklin.

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FORTY-EIGHTH PUBLIC MEETING

HELD AT

Brandon, Monday and Tuesday, January 17th and 18th, 1876.

PROGRAMME.

MONDAY AFTERNOON.

"Words of Welcome," E. H. Griswold, Brandon.

"Moral Influence of Agriculture," A. E. Stanley, Leicester.

"Manures and their Application," H. H. Merritt, Brandon.

MONDAY EVENING.

"Specialties in Agriculture," Dr. C. L. Case, Brandon.

" Harmony of Scientific and Practical Agriculture," H. A. Sumner, Brandon.

" Education for Farmer and Mechanic," J. S. Cilley, Brandon.

TUESDAY MORNING.

" Mechanical Drawing in our Common Schools," J. T. Hawkins, New York.

" Bee Keeping," Dr. F. Bond, Cornwall.

" Fine Sheep Breeding in America," E. H. Griswold, Brandon.

TUESDAY AFTERNOON.

" Sand Blast, and its Applications in West Rutland," J. B. Smith, West Rutland.

" Milk, and Mode of Handling," G. S. Fassett, Enosburgh.

TUESDAY EVENING.

" Agricultural Education," C. M. Bliss, Bennington.

" Fish and Game a Source of Wealth," Dr, M. Goldsmith, Rutland.

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FORTY-NINTH PUBLIC MEETING

HELD AT

Orwell, Tuesday and Wednesday, January 25th and 26th, 1876.

PROGRAMME.

TUESDAY MORNING.

" Address of Welcome," S. H. Bascom, Orwell.

" Farming as a Profession," Geo. Kimball, Orwell.

"The Grass Crop," C. Horace Hubbard, Springfield.

TUESDAY AFTERNOON.

"Sheep Husbandry," J. H. Mead, West Rutland.

"The Coming Horse for Vermont," E. S. Stowell, Cornwall.

TUESDAY EVENING.

"Increasing Danger of Mistake in Choice of Vocation," P. E. Pease, Burlington.

"The Education Needed by the Farmer, and Where to Get it," Edward Conant, Randolph.

WEDNESDAY MORNING.

"Ergot," C. G. Pringle, Charlotte.

"Will it Pay ?" D. A. Forbes, Orwell.

"Bees as Related to Fruit Raising," J. E. Crane, Bridport.

WEDNESDAY AFTERNOON.

"Some Points in Dairying," A. T. Smith, New Haven.

"Butter Making," G. S. Fassett, Enosburgh.

WEDNESDAY EVENING.

"The Work of Our Schools of Learning," Pres. C. B. Hulbert, Middlebury.

FIFTIETH PUBLIC MEETING

HELD AT

Fayetteville, Tuesday and Wednesday, February 1st and 2d, 1876.

PROGRAMME.

TUESDAY AFTERNOON.

"The Merits of our State," M. O. Howe, Fayetteville.

"The Value of the Farmer's Occupation," S. D. Conant, Grafton.

"Does the Market Demand a Change in Productions?" Jerome Holden, Putney.

TUESDAY EVENING.

"The Poetry of Farming," Mrs. Maria P. Rice, Fayetteville.

"The Coming Farmer," Jas. O. Follett, Townshend.

"Opportunities for Young Farmers," J. B. Mead, Randolph

WEDNESDAY MORNING.

"How ought Our Children, who are to till the Soil, to be Educated ?" Geo. M. Houghton, Townshend.

"Cattle Breeding," P. H. Rutter, Townshend.

WEDNESDAY AFTERNOON.

"Agriculture in Windham County," I. K. Batchelder, Townshend.

"Apple Culture," J. H. Putnam, Grafton.

"The Grass Crop," C. Horace Hubbard, Springfield.

FIFTY-FIRST PUBLIC MEETING

HELD AT

Pomfret, Thursday and Friday, February 3d and 4th, 1876.

PROGRAMME.

THURSDAY MORNING.

"Opening Address," Maj. Ora Paul, Pomfret.

"Pisciculture with Reference to Farming," George B. French, Woodstock.

"The Grasses," C. G. Pringle, Charlotte.

THURSDAY AFTERNOON.

"The Grass Crop," C. Horace Hubbard, Springfield.

"Sheep Husbandry," A. E. Perkins, Pomfret.

THURSDAY EVENING.

"Window Gardening, Mrs. W. C. Whipple, Pomfret.

"Opportunities for Young Farmers," J. B. Mead, Randolph.

FRIDAY MORNING.

"(Subject unannounced,)" Henry Lane, Cornwall.

"A Plea for Grass Culture," J. C. Sherburn, Pomfret.

"Leaves," H. M. Seely, Middlebury.

FRIDAY AFTERNOON.

"Farm Buildings," Henry Safford, Quechee.

"Does it Pay to feed Grain or Meal to Dairy Stock?" E. S. Wood, Pomfret.

"Farm Economy," L. O. Greene, Woodstock.

FRIDAY EVENING.

"In-doors," Mrs. E. S. Wood, Pomfret.

"The Education for the Farmer," H. W. Vail, North Pomfret.

FIFTY-SECOND PUBLIC MEETING

HELD AT

Rochester, Tuesday and Wednesday, February 8*th and* 9*th*, 1876.

PROGRAMME.

TUESDAY MORNING.

"Welcome," Dr. A. Richmond, Rochester.

"Potato Culture," C. G. Pringle, Charlotte.

"Care and Management of Horses," V. M. Hubbard, Rochester.

TUESDAY AFTERNOON.

"Sheep Husbandry," J. H. Mead, West Rutland.

"Improvement of Pastures," M. A. Ballard, Gaysville.

"The Grass Crop," C. Horace Hubbard, Springfield.

TUESDAY EVENING.

"Science on the Farm," H. M. Seely, Middlebury.

"Opportunities for Young Farmers," J. B. Mead, Randolph.

WEDNESDAY MORNING.

"Education of Farmers," R. J. Flint, Granville.

"Butter Making—Theory and Practice," A. Chapman, Middlebury.

"Cheese Factories," H. D. Morgan, Stockbridge.

WEDNESDAY AFTERNOON.

"Fruit Raising on our Hills," C. W. Sawyer, Gaysville.

"Should the People of Vermont raise their own Bread?" W. W. Williams, Rochester.

WEDNESDAY EVENING.

"Farm Life," Mrs. O. R. Eaton, Rochester.

"Home Life on the Farm," Pres. M. H. Buckham, Burlington.

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FIFTY-THIRD PUBLIC MEETING.

HELD AT

Chelsea, Thursday and Friday, February 10th and 11th, 1876.

THURSDAY AFTERNOON.

"Words at the Start," Ezra Walker, Chelsea.

"Scatterings," C. W. Clarke, Chelsea.

"Gleanings," Geo. F. Smith, Washington.

THURSDAY EVENING.

"Grasses," C. G. Pringle, Charlotte.

"Leaves," H. M. Seely, Middlebury.

FRIDAY MORNING.

"Sheep Husbandry," J. H. Mead, West Rutland.

"Horses for Vermont," A. Chapman, Middlebury.

FRIDAY AFTERNOON.

"Morgan Horses," J. F. Hemenway, Chelsea.

"The Grass Crop," C. Horace Hubbard, Springfield.

FRIDAY EVENING.

"Opportunities for Young Farmers," J. B. Mead, Randolph.

FIFTY-FOURTH PUBLIC MEETING

HELD AT

Bradford, Tuesday and Wednesday, February 15*th and* 16*th*, 1876.

PROGRAMME.

TUESDAY MORNING.

"Opening Address," R. Farnham, Bradford.

"The Horse," Dr. John B. Ormsby, Bradford.

"The Grass Crop," C. Horace Hubbard, Springfield.

TUESDAY AFTERNOON.

"Specialties in Farming," A. W. Paine, Fairlee.

"The Butter Dairy," G. S. Fassett, Enosburgh.

"Butter Making," Mrs. Eliza A. Barrett, Bradford.

TUESDAY EVENING.

"The Calling of the Farmer compared with other Call ings," Alex. McLane, Fairlee.

"Opportunities for Young Farmers," J. B. Mead, Randolph.

WEDNESDAY MORNING.

"Smut and Ergot," C. G. Pringle, Charlotte.

"Corn," Wright Chamberlain, Newbury.

"Does it Pay to raise Corn in Vermont?" Wm. Childs Fairlee.

WEDNESDAY AFTERNOON.

"The Potato," Z. E. Jameson, Irasburgh.

FIFTY-FIFTH PUBLIC MEETING

HELD AT

Waitsfield, Thursday and Friday, February 17*th and* 18*th*, 1876.

PROGRAMME.

THURSDAY MORNING.

"Opening Address," E. W. Bisbee, Waitsfield.

"Leaks in Farming," E. A. Fisk, Waitsfield.

"Smut and Ergot," C. G. Pringle, Charlotte.

THURSDAY AFTERNOON.

"Leaves as Fertilizers," Z. W. Boyce, Fayston.

"Commercial Fertilizers," J. Holden, Waitsfield.

"Saving of Fertilizers," J. B. Mead, Randolph.

THURSDAY EVENING.

"(Subject unannounced,)" Mrs. L. B. Boyce, Fayston.

"Farmers and their Calling," S. P. Joslin, Waitsfield.

FRIDAY MORNING.

"Grasses," C. G. Pringle, Charlotte.

"The Grass Crop," C. Horace Hubbard, Springfield.

FRIDAY AFTERNOON.

"Some Points in Dairying," A. T. Smith, New Haven.

"The Butter Dairy," G. S. Fassett, Enosburgh.

FRIDAY EVENING.

"Capital in Farming," G. H. Crandall, Duxbury.

"Opportunities for Young Farmers," J. B. Mead, Randolph.

SELECTION OF COWS FOR THE BUTTER DAIRY.

BY GARDNER S. FASSETT, OF ENOSBURGH.

For eighteen years I have been dairying, making butter exclusively during the whole time.

I have always given some attention to the selection and care of cows; usually, or until within a few years, depending upon my skill in buying cows adapted to the purpose I wanted them for, rather than raising cows from calves.

I thought it more economical than raising them.

If I succeeded in getting a cow with apparently a good, vigorous constitution, giving an abundant flow of milk with good care, that milked easy without shedding her milk, was contented to stay in the pasture and didn't kick, she was put on the permanent list.

If she proved defective in any essential point, after being tried a year or two, she was sent to the butcher. In this way, I succeeded as well as my neighbors, perhaps, or at least made as much butter per cow as others, and was quite well satisfied with my success.

But I never knew, during this time, by any well conducted experiments, whether each member of my herd was paying a profit, or whether I was keeping some cows at an actual loss.

This course, or substantially the same, has been pursued by the majority of the dairymen of Vermont, and is to a great extent the plan of to-day, so far as my observation extends.

Now this plan is entirely defective, and, unless abandoned for one which will result in securing to butter dairymen a better income, in proportion to the outlay and expense of running the business, cannot, in the future, meet the expectations of those engaged in this branch of husbandry.

But, fortunately, men of scientific knowledge have come to the rescue, and have given us, in practical shape, a vast amount of information upon the subject of breeding cattle for specific purposes, on the subject of milk and its constituent elements, and the manufacture of butter and cheese, so that the dairyman may be sure of a desired result if he follows the rules. Thus the relation of science to agriculture and dairying is beginning to be recognized, and is, in my judgment, a most hopeful indication, which should greatly encourage us in our labors.

Quite recently I have commenced testing my cows separately, to ascertain their relative value for the butter dairy. It is astonishing what a great difference there is in the value of cows as butter producers, not only in the amount of butter they produce, but in the quality of the butter, as well as the color, and particularly with regard to the readiness with which butter can be manufactured from the milk.

It is scarcely less astonishing what an effect judicious, liberal feeding has on a well bred cow, to increase the butter product, and diminish the labor of making butter.

In regard to breeding cattle: it is no longer a problem with me how the Shorthorns, the Ayrshires, the Devons, the Holsteins, the Jerseys, and the Brittanies, have and retain their characteristics, as fowls are bred, true to a feather.

It is brains that does it.

Nature's laws, as related to the breeding of cattle, though not in the least violated, are as much under the control of the experienced and skillful breeder, as the ship is under the control of the helmsman.

So in all our endeavors to improve our dairies, whether in breeding for a specific purpose, or selecting for a specific purpose, or feeding profitably, we need to understand nature's laws, and be able to trace a cause to its effect.

My experiments to test the relative value of cows as butter producers, and my observation and knowledge of what others have accomplished, in regard to selecting, breeding, feeding and caring for cows, have had the effect to make me somewhat enthusiastic on this subject, and I venture the assertion, without fear of successful contradiction, that if this subject were carefully studied, and such tests and experiments made as can be made at trifling cost, except application and work attended with pleasure, the net profit from the cows of Vermont, kept in butter dairies, would be doubled in ten years, even though the number should be decreased twenty-five per cent.

This may seem an extravagant statement, and, as we all like facts with the privilege of forming our own conclusions, I desire to call your attention to some of the results from careful selection and care of cows that have come under my observation and notice.

I have endeavored to make use of no statements which I did not feel sure were reliable.

A young man living in the town of Sheldon, purchased a farm, about three years ago, with a dairy of sixty cows. He soon commenced testing each member of his herd separately, with care, and found many of them were not profitable butter cows. After selling and buying, he had reduced his dairy to thirty-five cows. He told me, not long since, he had made as much butter from the thirty-five selected cows in one season, as from the sixty cows he bought with the farm, and, during the time, had accumulated a large amount of hay.

Of course, you will remember it costs less to take care of thirty-five than sixty. This dairy was composed of what are termed native cows.

Now I do not need to make figures to show that he has very much increased his net income. When this farm is fully stocked with such cows as the thirty-five, the net income must be more than doubled, and the owner have the satisfaction of feeling he has accomplished something worth his while

Another marked case is that of the dairy of E. S. Wood, Esq., of North Pomfret. I have visited Mr. Wood on two occasions, and become familiar with all his management. His dairy is composed of high grade Jerseys entirely. He attributes his success to the breed more than to his skill and good care, but whichever it may be, it is of equal importance as an example.

He commenced keeping Jerseys about eighteen years ago. Previous to that time, he tells me, he sold but little more than one hundred pounds of butter per cow annually; now he makes nearly or quite three hundred pounds of butter per cow annually, from his improved dairy of twelve or fourteen cows. He feeds, in addition to hay and pasture, perhaps twelve or fifteen dollars' worth of meal, per cow, yearly. He also makes a fine article of butter, and from its sale realizes over one hundred dollars income yearly, from each cow, besides that from the sale of surplus cattle.

This has been accomplished with care, but at little cash expense, as he has not purchased high priced animals, but graded up from a native herd, using thoroughbred males from year to year.

To show you how he has succeeded in breeding cows of uniform value as butter producers, I will give you an account of what four two years old heifers I purchased of him last year, have done in my dairy, the past season, at several trials. One of them came in the last of April and two more some time in May. The one that came in in April made the 12th of June, in one day, from 22½ pounds of milk, one pound and five ounces of butter. Another one, June 4th, from 19 pounds of milk, made one pound and five ounces of butter. This heifer afterwards gave several pounds more milk per day, but whether the amount of butter was correspondingly increased, I do not know, as I did not test her again until October 1st, but from other tests I have made, I conclude the butter was only slightly increased.

The third one, June 1st, from 23 pounds of milk, made one pound and five ounces of butter.

You will see that the three made each the same amount of butter per day, though the weight of milk varied.

The fourth one came in later, near the close of June, and was not tested but by weighing her milk until October 1st, when she made in one day, from 19½ pounds of milk, one pound and four ounces of butter, and the other three averaged over one pound each the same day.

All these trials were made when the heifers were having grass only.

In these tests in each case the time consumed stirring the cream did not exceed ten minutes, and it was stirred in a broad dish with a spoon.

While Mr. Wood was selling but little more than one hundred pounds of butter per cow yearly, his income was nearly or quite consumed for fodder, leaving him almost no profit; now, with his improved dairy and better care, his net income must be more than sixty dollars per cow, allowing over forty dollars per year for fodder, while his expenses for labor are only slightly increased.

Perhaps you say, a cow cannot be kept well a year for even forty dollars. My only reply is, every pound of butter made costs more than can be gotten for it if the entire expense is counted at the market price, but by economy, temperance and industry, dairymen do even succeed in getting a good, *honest* living, and sometimes lay by something for a wet day, besides being somewhat independent in their manner of living.

But the point I desire to make in calling your attention to Mr. Wood's dairy, is that his improved dairy is really worth, for net profit, many times his former dairy.

You say this is an extreme case. It is, but compare it with the average dairy of Vermont. One hundred and thirty-five, or, at most, one hundred and forty pounds of butter per cow, may be set down as the probable average yearly product in Vermont. In New York, in 1873, I think, it was found by careful estimates the average yield was 131 pounds per cow; but allowing the average yield of butter per cow in Vermont to be 140 pounds, and Mr. Wood's dairy will yield a net income of more than ten times the average dairy of Vermont.

I will now mention a still more extreme case, of a single cow, owned by Mr. William Thorp of Underhill. I quote from a letter from Mr. Thorp to W. S. Thorp of Morristown. This letter was given me at a meeting of the Board of Agriculture, Manufactures and Mining, held at Jeffersonville, soon after it was written, and its truth vouched for at the meeting.

"Our cow calved March 22d, 1875. We commenced to use her milk April 1st. There have been only two persons in our family. We have sold 395 pounds of butter to various ones for one hundred and twenty-four dollars. We have appropriated to our family use sixty-six pounds, making in all four hundred and sixty-one pounds as the summer product.

We fed our cow, from March 23d until June 15th, two quarts of corn meal per day. As soon as convenient she had plenty of grass.

During the fall months, we fed her in all five or six bushels of turnips. She is one-half blood Alderney, eight years old last spring, wintered on hay alone.

In May, she made in one week, sixteen and one-half pounds of butter."

Now compare, or rather contrast, this cow with another, owned by one of my neighbors.

The one of which I now speak, gave a large mess of milk, and was supposed to be a good one. First by accident, and after by careful and repeated trials, it was ascertained that her milk contained no cream of any value.

This cow was disposed of, and afterwards was kept in a butter dairy for two or three years at least, her owner supposing her to be a good one, because she gave a liberal flow of milk.

I ask you to sit down and calculate the relative value of these two cows, last spoken of, in the butter dairy.

I mention these extreme cases to show that there is a great difference in the value of cows for the butter dairy, that without actual testing may appear of equal value, and even the one of least value may seem to be much the best.

These *extremes* may not be found in any one dairy, but differences less marked are found in almost all dairies, and dairymen are liable, for want of having tested cows, to sell their best ones and keep the poorest, and breed from them, until milk is more abundant than cream.

Another man tested all his cows, and kept an account with them till he was satisfied he had five cows in his herd that did not pay expenses, by five dollars a head per year, and other five only exceeded expenses five dollars per year. He had kept ten cows year after year, getting no profit from them, while the rest of his dairy gave him the only profit he got.

There is also a great difference in the time required to perfectly cream the milk of different cows.

I have in my own dairy a high grade Jersey heifer that exhibits as good percentage of cream in one hour, when the milk is set in test tubes, as at any time after. The sixth of October last, I filled a six inch test tube with her milk, and it was carried at once in a person's hands, riding in a buggy, nearly four miles to a fair; it then showed nearly twenty-five per cent of cream, and did not show better afterwards.

Scientific men would say, the butter globules in her milk are large and uniform in size.

I have also a fine grade Ayrshire cow, eight years old: her milk shows the best percentage of cream in about twenty-four hours. The butter globules in her milk, or at least a portion of them, are small. Large globules rise quickly, small ones slowly.

You will readily see that if all our cows were like the Jersey heifer, it would greatly simplify the cream rising process. I believe we may have them by careful breeding.

Experiments prove that large globules rupture more easily in churning than small ones, and from this fact, it has been thought—and perhaps some experiments seem to prove—that there would be loss in churning cream containing large globules with cream containing small globules.

I chose the cream from these two cows with which to make an experiment to satisfy myself upon this point, remembering that one experiment does not always prove a thing, but helps to prove it.

I weighed carefully the milk, cream, butter and buttermilk of each cow separately, and noted the time required to churn each; also kept the conditions in each case as nearly alike as possible.

This experiment was made October 23d, last, when the cows were in the barn at hay, having two quarts of oat meal each per day.

The Ayrshire cow gave 22 pounds 4 ounces of milk; weight of cream 2 pounds; time in churning, forty minutes; weight of butter, one pound one ounce; weight of butter-milk, fifteen ounces. Buttermilk appeared rich, as though there were butter globules left in it.

The Jersey heifer, two years old, gave 10 pounds 8 ounces of milk; weight of cream, 1 pound 4 ounces. Time of churning, twenty minutes; weight of butter, 12 ounces; of buttermilk, 8 ounces. This buttermilk was as blue as skimmed milk.

The next day I mixed the milk of the two cows. Weight of milk, 32 pounds 4 ounces; weight of cream, 3 pounds 1 ounce; time of churning, thirty minutes; weight of butter, 1 pound 12 ounces; of buttermilk, 1 pound 5 ounces.

When taken separately, I had 33 pounds of milk, 3 pounds 4 ounces of cream, 1 pound 13 ounces of butter. Mixed, I had 12 ounces less of milk, and 1 ounce less of butter. The time in churning the mixed was just half way between the other two, so there seems to be no loss in this experiment. Another experiment might result differently.

The butter contained in globules is lighter than milk. The material of which the sack is composed, which contains the butter, is heavier than the milk. This is proved by the experiments of Dr. Sturtevant and others. Large globules, containing more butter in proportion to weight of sack, rise quickly, while the proportion of butter to sack may be so small in the least globules, that the whole may be heavier than milk, and not rise at all. So the larger and more uniform in size the butter globules are, the more perfectly can the milk be creamed, and the more easily churned.

Dr. Sturtevant has also found out, probably beyond a doubt, and it is a valuable discovery, that the butter is formed in the cow's udder by a process of budding and casting off from the same parent cells. This helps us to understand how liberal feeding will increase the size of the butter globules, and hasten the casting off process, as well as improve the color, just as liberal manuring and good cultivation make good corn.

I say this is a valuable discovery, and I advise every dairyman, who can have access to it, to read a paper prepared by Dr. Sturtevant and read before a Farmers' Convention, held at Woodstock, Conn., in December, 1874, on the subject of "Physiological considerations concerning feeding for butter and cheese, with the discussion following it." This paper, in my judgment, is worth more to those who may read it, if they will follow the instructions, than the entire expense of the Connecticut Board of Agriculture for a year. It contains a vast amount of valuable information on the subject of feeding for specific purposes. It was not my intention to say anything on any subject but selecting cows, but you will pardon me if I digress a little and say a word, as I pass along, on subjects so nearly related.

You will, perhaps, expect me to say something about breeds of cows as butter producers. You will see I have so far been confined to the selection of cows for the butter dairy exclusively. So with regard to selecting cows; it should be done with direct reference to the particular branch of dairying we are engaged in. If I were selecting for the butter product alone, I should select Jerseys, because they have, for a long series of years, been bred for that particular purpose, and that is what must be done to secure good animals for any purpose.

They are more uniformly good butter cows than any other breed I am acquainted with.

This degree of perfection has been reached at the expense of some desirable points in a cow for all purposes.

Some of the points in which the Jersey excels all other breeds, taken as a whole, are these: their cream rises quicker, simplifying the process of setting milk; their butter is yellower, can be churned from cream in very much less time, and can be churned at higher temperature with good results; their butter certainly does command a higher price in market than that of most other breeds. In short, they are a good machine to convert good food into fine butter, but they cannot give a large amount of butter from scanty feed and noxious weeds, any more than a miller can make good flour in full measure from musty wheat and cockle seed.

There are not enough Jerseys now so that all can have a dairy of them, and, if there were, I should not think it advisable, as there are other purposes for which we want cows, and we must have the noble Shorthorns, Ayrshires, Devons and Holsteins; indeed, cows of all these breeds have done wonders in producing butter, when bred for that purpose, while I do think too much effort has been made to breed for fancy points for the good of those who have so bred their cattle.

My advice is, strive to improve what you have, and rather than purchase high priced, fancy animals of any breed for cows, raise your own, grading up by the use of good thorough-bred males from a butter producing herd, the Jersey being my choice.

A good cow may cost too much, a poor one always does. Sometimes you can buy cows or heifers that have been bred with care for the butter dairy, at moderate cost, and thereby save years of time which would be required to raise your own to the same standard of excellence.

I do want to again urge the dairymen of Vermont to use thorough-bred bulls, and select them with great care, as the influence of the sire is almost always greater on the progeny than that of the dam. The same care is also necessary in selecting the cow to breed from.

The question "How may I know a good butter cow every time?" is the one which interests us most of all, perhaps, and it is one not easily answered to the satisfaction of all, or even most of us. I can only give my own method of selecting and testing, and that of some others.

There are certain marks or points good cows usually exhibit, that do not often lead a good selecter astray, if selecting for the production of milk. Prominent among these is a soft, velvety skin, and good feed helps to make a good skin.

Mr. C. A. Crampton of Swanton, who is as good a judge as I know, and almost a model dairyman, says: "I had rather have my hands than eyes with which to select a dairy cow," because he depends so much on a good skin.

Other marks are, full eyes, small horns, wide escutcheon, *a place to put a bag*, well spread teats of good size, large, crooked milk veins, with large orifice at their source. A slim neck is a good sign, also a slim tail, and clean limbs. Almost all good butter cows are bright and sprightly. A good, vigorous constitution is very important.

If you wish a cow giving yellow milk, the newly formed earwax is the best guide, if you do not have a chance to prove her.

But I do not rely on marks and points nearly as much as on test tubes. These tubes, sufficient for the purpose, cost only seventy-five cents per dozen, and can be found at druggists' and agricultural warehouses. L. L. Dutcher & Sons, St. Albans, Vermont, keep them.

Get as many tubes as you have cows ; bore a row of holes in a narrow strip of board and write the name of each cow opposite a tube, or in some way mark so as readily to distinguish each one.

Now fill each tube with milk from cows as designated, note the time the cream is rising in each tube, see if the separation is complete and distinct, examine the color of the cream, its solidity and percentage, also see if the milk under the cream is bluish ; if the milk is bluish and the cream rises quickly, the butter globules are large and of uniform size. So much carefully done, and you will see there is a difference in cows. Of course, the cow's milk must be weighed carefully to have these tests of value.

This experiment needs to be repeated at intervals, as the varied condition of the cows varies the percentage materially, and the dairyman that has the sharpest biting dog, and uses him most freely, will see the greatest variation in the percentage of cream.

I mean by this that Hon. E. D. Mason, of Richmond, gave correct directions for driving cows, at an agricultural meeting in Utica, New York, when he said, " I send the laziest man I have after the cows, and if that don't answer, I go myself."

Having carefully made such experiments as I have spoken of with tubes, you are prepared to make the first weeding in the dairy.

Then continue experiments, by setting each cow's milk in separate pans, after weighing, and churn the cream from each pan by itself, again noting all the items: how much butter in proportion to milk in each case, how long it takes to churn each, the color of the butter, also the solidity, &c., and you are prepared to make an almost final selection.

It requires time and patience to do this, but remember one good cow that will yield a net income of twenty-five dollars, or more, yearly, is worth a good many that barely pay expenses. The profits must all come from what can be made above expenses.

All this done and well done, and yet, without care and good management, the dairy will run down. Barns should be made comfortable for cattle, warm enough to prevent freezing in the coldest weather, and the cows kept in them when they prefer it to being out of doors. The logic is dollars and cents.

Of course, stables should be well ventilated, but warm quarters do much to keep up the flow of milk in winter.

Cows must have plenty of good, pure water, and a good bed of straw, sawdust or forest leaves adds much to their comfort and saves much of the liquid manure now being wasted in Vermont.

Cows enjoy being petted and carded, and it does much to make them gentle. I have a great deal of respect for good cows, and would discharge a hired man for abusing a cow sooner than for almost any other fault.

If a cow kicks while being milked, I would tie her legs carefully together above her gambrels, and keep on milking as though nothing had happened, but never strike her.

The subject of the size of cows is discussed considerably recently. I have never considered it one of great importance, and yet it demands some attention. A cow consumes of good hay about three per cent of her live weight daily, to support life and repair the waste; if a large cow will, when not used for the dairy longer, make enough more beef than the small one that makes the same amount of butter to pay for the greater amount of fodder consumed during the years she is kept for a dairy cow, she is worth the same, and this is the best rule I know of by which to judge of the relative value of large and small cows in the butter dairy.

The cow is a quiet animal naturally, taking but little exercise of her own choice. This suggests plainly the importance of supplying to the cow an abundance of good food.

The manner of milking is of importance. The utmost care should be taken to milk at stated intervals, especially when cows are giving full messes.

Here again science has lent a helping hand. It is proved by actual experiment, that if milking is delayed beyond the usual time, or until there is pressure in the udder, nature undertakes to relieve by the process of absorption, thus not only reducing the aggregate amount of milk, but greatly reducing the cream percentage.

I have seen a statement from the Superintendent of the Ridge Hill, New York, Creamery that by tests he had ascertained the night's milk of cows which were not milked until fifteen hours after the morning milking, required 5.27 pounds more milk for a pound of butter than the morning's milk. The thinking, practical dairyman will make use of such an experiment, and it may result in getting him out of a net he has long been in.

We do well to read much on subjects relating to our interests. Take a good agricultural paper and pay the printer well.

I like the plan of tying cows in a stated place to be milked; it secures quiet, to say nothing of the moral effect of being kicked over without much warning. It is well to milk the same cow first each time.

I have thus briefly touched upon the points in this subject that interest me most. I desire to say only, in conclusion, what I have in detail said before. One good, well bred, well fed cow may be worth a dozen poor ones in the butter dairy, and we need to select them with great care. Think and investigate at every step, and we shall be rewarded with seeing the labor of dairying greatly reduced, and enjoy the luxury of a better filled purse.

FEEDING GRAIN TO MILCH COWS.

BY E. H. CLEVELAND, OF FRANKLIN.

The dairy business, as conducted by a majority of those engaged in it in this county, is not a business that pays a large return for the capital and labor invested. I have been astonished, while looking up the results of this branch of industry, the better to qualify myself to discuss the question assigned me on this occasion, to learn what small returns are realized by a large number of our dairymen.

I have taken a great deal of pains to ascertain the difference in the receipts of dairies fed grain, and those that are not, and I am sorry to say that there are altogether too many dairies in this county that do not yield one hundred and twenty-five pounds of butter per cow annually, and for which the average price received has not exceeded twenty-eight cents a pound for the same. This only gives thirty-five dollars for keeping a cow one year, and for the laber of milking and making the butter. Every intelligent farmer knows that at this rate a farm cannot be made to pay expenses. I do not intend to convey the impression that the dairies that are not fed grain will not average more than these figures, but will be liberal and place the average production at one hundred and forty pounds to the cow, which, I think, will exceed rather than fall below the actual results. Now if we figure this yield at thirty cents a pound, we shall find that a dairy of twenty cows will produce eight hundred and forty dollars in butter during the season. It certainly will not take a very close calculating man to see that no farmer can afford to hire help, at present prices for the same, and carry on dairy operations with such small returns. But let us see if we can not better the case by feeding grain. I think I communicated with about ten different men who have fed grain to their cows, and in every case have found the most gratifying results. Those that have followed this practice, have made their cows to yield from two hundred to two hundred and fifty pounds each. And another thing: I find that the butter made from cows fed grain will command a higher price in market, other things being equal. I need not dwell upon this point, for I think it will be conceded that the better the quality of the food the cows receive, the better the butter produced. Any man that has not tried feeding grain, will be surprised at the difference in body, color and flavor of butter made from grain fed cows. I think I am safe in concluding, from what I have learned by interviewing enterprising dairymen, that at least two cents more per pound have been realized by those that have fed grain than by those that have not. Now if my conclusions are correct, we need figure no further to find that we can make dairying a more remunerative business than it is to-day. But I wish to go through this subject to the end, and see where we shall come out. To give the old system the benefit of a doubt, if any should claim it, I will call the average of grain fed cows, two hundred and ten pounds, and the increased price obtained, equal to one cent a pound only.

Now then, take two farmers, for instance, whose lands join, and who keep twenty cows. Their pastures and general management are similar, with this difference: A feeds his cows on the old plan; gives them what hay they require in winter in order to bring them through in fair condition, with pastures in summer, and makes two thousand eight hundred pounds of butter, which, at thirty cents a pound, would amount to eight hundred and forty dollars in the aggregate for the season. B is not satisfied with these figures, so he adds to the feed of his cows four quarts of coarse middlings a day to each, through the entire milking season, and obtains the following results: four thousand two hundred pounds of butter, for which he realizes one thousand three hundred and two dollars, at thirty-one cents a pound. He has fed nine tons of middlings, which, at twenty-four dollars per ton, would amount to two hundred and sixteen dollars. Deduct this from the receipts for the butter, and he has left one thousand and eighty-six dollars. A gets forty-two dollars per cow, B fifty-four dollars and thirty cents, or twelve dollars and thirty cents more than A, after deducting the cost of the meal.

Now I calculate that B has been amply repaid for the trouble in feeding his cows this grain in their extra condition, when it comes fall, and in the less amount of hay they will require the following winter; so I think it but fair to figure what he got more than A, after paying for this grain, as extra profits on the money invested in its purchase.

This amounts to the snug little sum of two hundred and forty-six dollars, no inconsiderable amount, as all will agree, for a small farmer to have at the end of the season's toil, in addition to his usually small returns. But some may say that this is easier said than done. Well, if such do not believe the statement, they will not be very likely to try the method given, and so will not know by actual experience. I have no doubt that these results, substantially as I have figured them out, can be realized by every dairyman in the county.

I have come to the conclusion by extensive communication with successful dairymen, receiving from them their *actual experience* in the matter.

I have given, in substance, the facts and figures in a general way, but not so specifically as I hope they will be given by the gentlemen themselves.

In addition to this I would say, that my own experience during the past season, in regard to this matter, has been highly satisfactory, and fully confirms all I have claimed, in favor of feeding grain to milch cows.

MEAL FOR DAIRY COWS.

BY E. S. WOOD, OF POMFRET.

I often hear the question asked, "Does it pay to feed meal to cows?" And again it is said, "If I knew I could get my money back, I would feed meal." The question might with the same propriety be asked, "Does it pay to feed meal to anything?"

How often the farmer feeds large quantities of meal to beef cattle and to hogs, without realizing half its cost. It will be my object, in the short time I shall occupy, to show that meal can be fed to dairy stock and make it pay. It should be borne in mind that it must be judiciously fed, and fed to the right stock. That meal can be fed with profit, in any quantity and to any stock, is not so sure.

It was customary, in years past, when farmers were short of hay, to browse their cattle, as it was called; they took them to the woods, where they had been getting wood, and, in many instances, felled trees on purpose for the brush, to use as feed for their stock. Any way to get them through the winter! They realized so little from their cows, that it would not pay, they thought, to feed them meal. The small quantity of butter or cheese made, and the low price obtained, would not warrant any such expense. But, as browse grew scarce, they were under the necessity, when there was a scarcity of hay, to resort to the feeding of grain of some sort, in order to get their stock through the winter. It was a sad state of things for the farmer to be thus short, and to be obliged to feed out his corn, if he had it, and if not to be at the expense of buying it; but, after going through a few such trials, it was found that cows came out better in the spring, and were really the better for the scarcity of hay, and the grain they had received in consequence.

By feeding meal from necessity, farmers began to learn that it would pay to feed it to cows, working oxen and horses, in the spring. Their oxen would perform twice the labor with grain, keep in much better flesh, and in a more healthy condition. It used to take nearly all summer to fatten oxen, after they had done a hard spring's work without meal. Horses were only fed grain when they were to perform some hard day's work, or be driven on a long journey. How different now! No one pretends to keep a horse without feeding it daily with grain. Most people say they can keep a horse with about the same cost, to give it considerable grain, that they can on hay alone, and that it will perform much more labor; yet these same farmers, who feed grain to their horses, and make beef of their oxen, on meal, at the low price of beef at the present day, are in doubt about its paying to feed meal to dairy stock. In our own case, after twenty-five years' experience, we are quite sure we realize much more from meal fed to dairy stock, than when fed to any other. It is much easier to produce one hundred pounds of butter, than to grow four hundred pounds of beef or pork. In the latter case it requires considerable capital, as we get no pay until the end of the season, while in the former, we get returns each day, and in proportion to the amount fed. Nearly all farmers, at the present time, agree that it pays to feed meal to cows in the spring, when they are giving milk, because they have tried it and know; but, they say, "What is the use in feeding meal when the cow can get all the grass she wants? Is there anything better than grass?" We answer, no, grass for the cow is the staff of life, the same as bread is for man, yet she would pay for something more hearty, when giving a large flow of milk, as well as the laboring man would for a slice of meat with his bread. The cow should be kept in as good condition, while giving milk, as possible, for a cow in good flesh gives much richer milk than when poor. All farmers know that their cows lose flesh fast when their meal is taken off, and they are turned to pasture, also that there will be a falling off in the amount of butter. The amount of milk will increase, but the cream will be thin, and will not have the body, nor make so much or so good quality of butter, as when fed meal.

The amount of milk required to make a pound of butter, according to the report of many creameries and private dairies, where meal is not fed, varies from twenty-three to forty-six pounds, while on many trials of our own dairy, in the month of June, it required a fraction over sixteen pounds. If the average cow has two quarts of meal per day, she will hold her flesh better, look sleek, and be strong and sprightly. The amount of milk in June, perhaps, will not be more, but when the feed fails from drought, she will keep up a much larger flow of milk. It is of quite as much importance when feeding fodder-corn, and through the fall and winter. By feeding meal and shorts, cows can be kept in milk the most of the winter, and a good quantity and quality of butter made. Besides, when meal is fed, a greater number of cows can be kept. It is estimated that one ton of meal is worth nearly as much as two of hay, as feed for wintering stock, where butter is not taken into account. It has been proved to us in the case of Miller of New York, and others, that cows can be wintered on meal alone, and at a less cost than on hay. But to show you more clearly that it pays to feed meal, I will state a few facts in connection with my own dairy and manner of feeding. My pastures are quite limited, only sufficient to summer eight or ten cows without the use of meal. The past season I have kept fourteen, (all kept at home except two were away nine weeks, being dry in the summer,) and have fed two quarts of meal, or its equivalent in shorts, to each cow, for ten months, or while they are giving milk, at a cost of $280, or $20 per cow, allowing the meal to cost $40 per ton, which is a little more than the average cost of meal. They have made, in the past year, four thousand pounds of butter, a little less than three hundred pounds per cow, which, at thirty-five cents per pound, would be $1,400.

Now I estimate, for I do not care to try the experiment to obtain the facts, that did I feed no meal, I could not keep more than twelve cows on the same land. Truly, $280 is a great outlay for the keeping of two cows. But let us see how the account stands. Two hundred pounds per cow, which would be a large estimate without meal, would produce two thousand, four hundred pounds, which, at thirty cents, would bring $720, or a difference of $680, and a loss of $400 on butter alone. The extra amount of sour milk produced in the former case, as feed for calves and hogs, would be of considerable value, and the value of so large an amount of grain fed, as a fertilizer for our worn out farms, I shall not attempt to estimate, but think it much cheaper and better than to buy the popular phosphates, which are so much resorted to at the present day.

A few words with regard to raising dairy stock, as it is quite as important and difficult as any part of dairying. Calves should be allowed to run with the cow until two or three days old, then they should be separated and put some distance apart, so that they will not hear each other's calls, and where the calf can have plenty of exercise. It is then fed about three quarts of new milk for one week, then on milk set twelve hours for another, and then on milk set twenty-four hours, and so gradually change it to sour milk, making it about the same temperature as milk drawn from the cow. At this time, or when the calf is about four weeks old, it will begin to eat hay, which should be kept by it, and it should be fed a little bran or oats or both, in a small box prepared for the purpose. The amount should be very small at first, and gradually increased, without increasing the amount of milk fed. In this way, the calf can be kept in a healthy condition, avoiding all those difficulties arising from over feeding with sour milk and meal. When it is of suitable age, it may be turned to pasture, if desirable, but will be much better if kept up through the hot weather. Much care should be taken, as cold weather comes on, that they do not suffer from cold nights and storms, but that they come to the barn in good condition; then they can be wintered as easily as any other stock. A little grain will be of much value to them in the winter, and even through the next, if they are coming in at two years old, which I think desirable.

And now if any thing which I have said on this occasion would induce farmers to keep their dairy stock better, my object will have been accomplished.

ASSOCIATED DAIRYING.

BY C. W. MUDGETT, OF WEATHERSFIELD.

The dairy has become an important branch of national industry. It is rapidly spreading over new fields, and is engaging the attention of farmers in the Western, Northwestern and Middle States, wherever the lands are adapted to grazing, and there are springs and streams of living water. The dairy districts, though comparatively limited, embrace a larger area than has been generally supposed.

It is true there are extensive plains at the South and Southwest, where the business of dairying cannot be carried on, but broad belts and isolated patches of land are scattered over our vast domain, well adapted to grazing, and such lands, when taken in the aggregate, cover a wide extent of territory. There are two causes that have been operating, in the last dozen years, to stimulate the development of this branch of industry, and have caused it to assume proportions that give it a distinctive feature of nationality.

The first is a large and increasing foreign demand for dairy products; the second is the American system of "associated dairies," now brought to such wonderful perfection that the business is being readily introduced into new sections, with all the ease and certainty of success in producing the qualities attained in old dairy districts.

The foreign demand for cheese, it is believed, will be permanent, and exportations from year to year must largely increase, since the finest American grades are acknowledged to be equal to the best manufactured abroad, while the cost of production is so much less as to render competition with European dairies an easy matter on our part. This fact alone gives confidence to those entering upon the business of dairy farming—that it will be remunerative and enduring.

In addition as the texture and flavor of cheese have improved, a large home demand has sprung up, which requires large quantities to meet its wants. It is stated by those thoroughly conversant with the matter, that the home demand, for years to come, will more than keep pace with the increased production.

With a constantly increasing home trade, and a reliable foreign market, no branch of farming to-day offers better or more permanent remuneration than the dairy.

Previous to 1830, dairying in the States comprised but a small proportion of the income of our agriculturists, and, until 1850, but little cheese had been shipped abroad. All the operations of the dairy at that time were rude and undeveloped. The herds were milked in the open yard, the curds were worked in tubs and log presses. Everything was done by guess, and there was no order, no system, and no science in conducting the operation. It was not till 1851-2, that the foundation of the first cheese factory in the country was laid in Oneida County, New York, and, for the ten years following, but little was accomplished in pushing forward the enterprise. But at this time the associated dairy system began to attract attention.

The system was first inaugurated by a substantial farmer by the name of Williams, living at Rome, Oneida County, New York, and was suggested from mere accidental circumstances. Mr. Williams was an experienced and skillful cheese maker; his dairy, therefore, enjoyed a high reputation, and was eagerly sought for by dealers. One of his sons, having married, entered upon farming on his own account, turning his attention to dairying, and proposed to lift his debt by cheese making. But he could not be sure of as good prices as his father's make always commanded. It was therefore arranged between father and son, that the milk from the new farm should be brought over in cans and made up in the paternal cheese room. Meanwhile the father had contracted the cheese at a figure considerably higher than was being offered for other dairies in that vicinity. The plan worked admirably, and the next year neighbors sought admittance as partners or patrons. It was from this small beginning, that has sprung into existence one of the greatest industries of the agriculturists of this country, and relieved thousands of its burdened and over-worked farmers' wives of the heavy drudgery of the cheese room. And here it may be proper to observe, that one of the inconveniences which is widely felt among dairymen results from the difficulty of obtaining careful and reliable hands for the management of the dairy. If it is desirable to make first class cheese, that will command in market the highest price, all the operations of manufacture must be performed by tried and skillful hands, hands that can rarely be obtained for hire, and, when obtained, command comparatively large wages.

Now as cheese making is an art, which must be learned like other trades, and as most of the operations are performed by females, the dairy farmer may be said to have, for the most part, nothing but apprentices in his employ, for when his dairymaid has been carefully taught the trade, she marries, and is at once lost to him.

The scarcity of skilled cheese makers is severely felt through the whole dairy region, necessitating to the farmer and his family, and more especially the female portion, arduous labors, taxing their strength to a degree that tells heavily on health and constitution. The result is, that persons prematurely aged, and with broken health, are more frequently found in a dairy region than in other farming communities. There is no desire to say one discouraging word of a business which has added so much wealth to the country, and in which those who are engaged generally prosper, and soon become independent in worldly goods; but the truth must be told, nevertheless. Wealth has its advantages, but its price should be kept in view, and, if overtasked muscle, incessant care without relaxation, and finally disease, is to be the patrimony of wives and daughters, its charms, to say the least, are very much diminished.

Dairymen are conversant with these facts, and they are points to be considered, and should have their proper bearing in making up our estimate of the two systems.

The advantages of the factory system are, superior quality, uniformity, higher prices, a saving, by buying at wholesale such materials as salt, bandages, annatto, boxes, &c., and, finally, relieving the farmer and his family from the drudgery of the manufacture and care of cheese.

It is not pretended that a better quality of cheese can be made at the factory than in families, but, that it is quite as fine as the best, and therefore above the average of that manufactured in small parcels.

I have enumerated some of the causes that conspire to depreciate the quality of cheese, when made in single dairies; these are not present in the factory system. The agent or superintendent makes it his business to see that all parts of the work are properly performed. He employs skillful workmen, and his interests and reputation are at stake, prompting him, at all times, to do his best. He knows that neglect or mistakes will not be tolerated, and the desire to satisfy persons interested, in order to secure their patronage, stimulates him to make every exertion to build up and sustain a reputation for *fine goods.* He has every convenience at hand for manufacturing to advantage and making the business a sole employment. He is not liable to be disturbed by other matters, which might serve to call his attention away from time to time, to the prejudice of the immediate work at hand.

The same rule must hold good with him, as with those engaged in other professions and arts, for he who gives his whole attention and energies in a certain direction, is likely to become more skilled, and arrive nearer to perfection in his calling, than he who is striving to do many and diverse things at the same time, more especially in cheese manufacture under this system, as a high degree of skill is expected, and jealous and interested eyes are daily watching and noticing every short coming. Uniformity and fine quality are more likely to obtain under this system, and whatever prog ress can be made towards improvement will naturally develop itself more rapidly here than among persons scattered over a broad extent of country, and who are so occupied with a variety of work as to have little time to spend in the improvement of one particular branch. The most important advantage to farmers in this union arrangement, is the relief from the drudgery of cheese making, and the constant care and attention necessary in properly curing and fitting the cheese for market. It would be difficult to estimate this in dollars and cents, since health enters into the account more largely than is generally suspected. As the same process has to be gone through with, in manufacturing cheese, whether the quantity of milk be large or small, and as nearly the same time also is occupied, it will be seen that what requires the labor of a great many persons to do, when cheese making is divided up in families, can be accomplished with but few persons in the factory system, some five or six being sufficient to do all the work about an establishment manufacturing the milk of a thousand or more cows. The question is frequently asked, is the factory system destined to stand the test of years? Is it to continue to prosper, or will it not soon break up and dairymen return again to the old order of cheese making. In my opinion it is to live, The system is a progressive step, and all history teaches that when that is taken, it is difficult to retract it.

Doubtless some may remember when the wool and the flax, grown on the farm, were spun and woven in the family. We shall never return to that again, because we cannot afford it. They can be more cheaply manufactured by associated capital, substituting the untiring arm of the machine for one of living muscle. The flesh and blood of our wives and daughters are of too much consequence to be worn out by this ceaseless toil, when the spindles and looms, driven by steam or water power, can relieve them of the burden at a fraction of what it costs in home manufacture. Why then should a neighborhood of dairymen do the work of cheese making in families, employing many hands, when it can be performed equally well by half a dozen persons in a well constituted factory. The inauguration of associated dairies is rapidly producing a revolution in old customs and heretofore fixed ideas. It teaches the important lesson that farmers can adopt successfully the same means that have proved so beneficial to the merchant, the banker, and the commercial man of the world. By a consolidation of interests, the dairyman of to-day can wield a power and influence never before reached.

BUTTER MAKING.

BY G. S. FASSETT, OF ENOSBURGH.

The object the dairyman has in view in all his labors, is to accumulate property, or, at least, to secure a good and sufficient living, and it should be the second thought to accomplish all the possible good he can. You will, no doubt, agree with me, when I say, the profits of the ordinary butter dairy are not very large. To increase the profits, some plan must be devised to make more butter from each cow, and so improve the quality as that it will command more remunerative prices. It is not my intention to write an exhaustive paper on this subject, if I were able, but to make some suggestions, which may be practicable and of use to butter makers.

I would not recommend any great changes, but a more careful study of the subject in general, with a view to improvement.

If it costs twenty-four cents to make one pound of butter, and it can be sold for thirty cents, the net profit is, of course, six cents on a pound, or three dollars on a tub of fifty pounds; and if a cow produces one hundred and thirty-five pounds per year, the probable average in Vermont, the net profit from a dairy of twenty cows would be one hundred and sixty-two dollars. Now if the quality of the butter made is so improved as to bring thirty-five cents per pound, and each cow will produce two hundred pounds, and all our dairies ought to produce as much, many do a good deal more, the net profits from a twenty cow dairy would be increased from one hundred and sixty-two dollars to four hundred and forty dollars, or nearly three times as much. Too much of the income is now consumed for running expenses.

Success in butter making depends upon the careful observance of nature's laws. Pure milk is the basis or starting point, free from taint or unpleasant odors. To secure this, the cow must be in a healthy condition, abundantly supplied with food containing butter producing elements, must have pure air and pure water. Gentle treatment is very necessary, also, as the nervous condition of the cow affects the quality and quantity of the butter product.

In short, if the cow is obliged to eat food or drink water containing germs of putrefaction, though the organs of secretion may be laid under tribute never so much to remove the difficulty, the germs of putrefaction will appear in the milk. Not only must the milk be pure, but of peculiar quality, to be most easily and profitably handled. Some milk is rich in cheese, that fails to yield well of fine butter; some milk yields butter of much richer color and texture. Some cream comes to the surface of the milk more readily, and is much more easily and quickly churned, and can be churned at a higher temperature with equally good results.

All these good qualities in milk help to facilitate the process of manufacturing.

Though the milk may be pure in the cow's udder, yet, as soon as drawn, is as unprotected from surrounding taints as slaughtered beef in warm weather.

In the process of milking, it has its enemies in the form of dust or dirt in the pail, and in the crevices are often concealed the fungus germs. So all the way from the milking yard to the market, dainty neatness is required. The milk room need not be expensive, but should be as cool and convenient as possible. For a strainer, good sheeting cloth is not too thick, if the milking is properly done, and a dozen agents, with commendable zeal to earn an honest dollar, are ready, with their favorite pattern of pan or pail, in which to set the milk, and praise, with well selected adjectives, its points of excellence.

Any of the patterns of pans or pails are an improvement upon the small pan, as the saving of labor is thereby greatly increased, and the quality of butter made in some dairies is much improved by substituting large pans or pails for small pans; but, from observation, I am fully convinced that the improvement is the result, mainly, of reducing the creases where fungus germs are too often deposited, and compelling skimming more promptly, rather than due to any particular form of pan. As regards vat coolers, I should recommend them or the pail system, where running water can be had at moderate cost; but for use in small dairies, it is quite a question whether the large, dry pan is not preferable.

The advantages of the dry pan, or pan without coolers, are, it is much more durable, probably lasting the lifetime of three vat coolers; it is more easily taken care of; it does away with the difficulty from dampness, occasioned by condensing the moisture in the atmosphere. Moisture creates an odor like mildew. The same mildew odor comes from mopping the milk room in a damp day. The moderate cost of the dry pan is to be looked at too.

If the milk is slightly cooled by setting the carrying pails of milk in a tank of cold, running water, before straining, the result is very satisfactory. In some large dairies, of forty cows or more, this plan, with the addition of ice with which to cool the air in the milk room, has resulted well. Dry air is always preferable to damp for rising cream, and some invention for cooling milk rooms, by the introduction of dry, cool air, would, in my judgment, supersede nearly all the methods now in use.

The Swedish mode of making butter, adopted by Mr. Harding, of Kentucky, I have not yet tested, but intend to do so the coming season.

We should all try experiments on a small scale, and if each one does not succeed, something will almost always be learned that will more than compensate for the trouble.

No one need be discouraged because he does not feel able to purchase large pans or pails, while he has a supply of small pans, for some of the most successful dairymen of the State, who make the finest butter, use the old fashioned small pans. If milk is cooled by artificial means, in the usual way, it must be done with care, and not below sixty degrees, or the animal odor will not escape. I think a little careful experience will satisfy any one on this point.

As regards deep and shallow setting, both are equally satisfactory in results, if all the conditions can be and are complied with, but I feel quite sure the inexperienced dairyman will not succeed with deep setting. Almost every time, under ordinary circumstances, shallow setting will yield the most butter, and the butter will be slightly yellower, though butter made from deep setting will afterwards mature to as good color, perhaps.

Many things are yet to be learned about setting milk.

While milk is setting for cream, every odor like that from a pig pen, a slop hole, or from smoked meat in a milk room, or smoke from a defective stove pipe, or from tobacco, will attach itself to milk, and appear, in concentrated strength, in the butter.

The milk room must be, at all times, free from every unpleasant odor, and the nearer the temperature of sixty-five degrees the atmosphere in the milk room can be kept the better.

It is while milk is setting for cream, the white specks or curds are formed, so very objectionable in butter; and they are also a waste, as they are cream dried till it will not make butter by ordinary churning.

To remedy this loss, the cream strainer or cream pump is used; this does break up the particles of dried cream so nearly all of it can be made into butter, but dried cream can never be made into fine butter, and the same cause that makes the dried cream appear at all, injures all the cream. Much better to remove the cause than be obliged to use a remedy, at any rate if the remedy is only partial.

Cream is dried by currents of air passing over it, not necessarily by wind blowing on the milk, but frequently agitating the air, by going in and out, will do it effectually. Much ventilation in a milk room is more beneficial theoretically than practically.

The best way I know of to prevent dried cream, is to remove from the room everything but the utensils necessary for rising cream; then the errands to the room are few, the air remains stiller, and the cream rises better.

Some learned men speak of seeing white specks that are not dried cream, but I think they will never be found unless the milk has stood so long in hot weather as to separate from the whey and dry into "Dutch cheese." No prompt dairyman will ever see them. Professor Collier says: "Every specimen I have examined, proved to be dried cream."

As to how long milk must stand to be perfectly creamed, or even profitably creamed, I cannot give a rule that will apply to all circumstances or all dairies, for, as I indicated in the outset, the cream of some cows rises much more readily than that of others. Liberal feeding of concentrated food to cows, causes cream to rise and mature sooner. Everyone who has made the trial to ascertain how long cream would be rising on the milk of the different members of a herd, has noticed a marked difference in the time required; also that a portion of certain cows' cream will come to the surface soon, while the smaller globules, which make only an inferior quality of butter, rise slowly. Better not wait for a little poor cream rather than have the whole injured by standing long. A little less fine butter will sell for more money than a greater quantity not as good.

With the temperature in a room at sixty-five degrees, thirty-six hours is sufficient time, with exceptions.

If the milk is commencing to thicken at the bottom, it should be skimmed at once, usually.

In warm weather, small, light colored spots appear as soon as the milk has stood too long.

So nearly all the cream rises in the first twelve hours, that nearly all the time cream needs to be on the milk longer is to become so matured as to be taken off readily with the skimmer.

The cream needs watching, and be sure to skim soon enough.

Many have lost their reputation as butter makers, by prolonging a pleasant visit, when the dairy room was being neglected.

Two or three tubs of poor butter, made and sold at intervals during the season, may cost too much.

Uniformity in quality does much to establish a reputation for a butter dairyman, and aids him in getting a good, paying price.

After the cream is removed from the milk, but little time should elapse before churning, as cream injures very soon unless kept quite cool; forty-eight hours is long enough, twenty-four is better.

Tin pails are best in which to keep cream. It is a good way to set the pails of cream in cold running water, or in a cool cellar, if the air is pure. The cream should be as free from milk as possible; it will churn quicker and keep longer. If there is whey in the bottom of the cream can, the cream has stood too long, and will never make fine butter.

I come now to the churning process. "What kind of churn is best?" is a question often asked.

Half a dozen men say: "Mine; because it will churn in less time and get more butter from the same amount of cream than any other made." These are good qualities in a churn, if they are not secured at the expense of other indispensable ones.

The first thing to be thought of is, which does the work best, or makes the best butter? Then add as many other good qualities as possible. I tried a whole season to succeed perfectly with an "up and down," horse power churn, but could never get uniform agitation so necessary, and this same difficulty is more or less apparent in most, if not all, float churns.

My choice is the square box, revolving churn, with no floats in it. Any churn involving the same principle, like "Bullard's Oscillating Churn," or the revolving barrel, is as good. The box churn is very simple in its construction and operation.

In using any form of churn, the temperature of the cream, during the whole process of churning, is *the* important thing to look after, and cannot be neglected with any hope of success.

I often hear dairymen say, they have a spring or a well in which they set their cans of cream, and the cream is cooled just right to churn. That is the best way I know of to prepare the cream for the churn; but ask them at what temperature they keep the cream while churning, and many of them will say, "I don't pay any attention to that. If it comes too soft, I harden the butter with ice."

No man need expect to succeed in this way, unless the temperature of the room in which the churning is done is about fifty-eight or sixty degrees. Butter that is warm and soft when it comes, can never be hardened by any means so it will endure heat on the table.

I am speaking now of making butter in warm weather.

Cream from a selected herd of cows, like the Jerseys, for instance, or from cows fancy fed, can be churned at a slightly higher temperature, with good results.

Fifty-eight degrees is about the right temperature at which to churn in warm weather, varying to even sixty-five degrees in winter. If it is extremely warm, the temperature should be reduced to fifty-six degrees and kept there.

It requires a higher degree of heat to melt butter in winter than in summer, and it will be more like grass butter to churn it at sixty-five degrees than at fifty-eight.

If butter is churned too cold, it will be tallowy and light colored; if too warm, salvy and light colored.

The color of butter should be kept nearly uniform throughout the year, by the use of some artificial coloring material. I have examined all the annatto preparations offered in the market, but have never found a good substitute for orange carrots.

The churning should not be done very rapidly; especially is there danger of churning too fast with horse power. Rapid churning makes butter salvy. Churning after butter comes, or separates from the caseine, robs it of the gloss so inviting to the eye of the butter fancier. If the temperature is kept rightly, churning should stop when the particles of butter are the size of from shot to butternuts, and if the churn is turned ten times after that, the gloss is gone and cannot be restored by any process.

If the churning is well done, the remaining work is more easily done well. The buttermilk should be drawn off from the churn, and the butter rinsed in the churn; but to remove all the caseine, the butter must be worked with the hands in the tray, in water, or, perhaps, three waters, till the water runs off clear; or, if worked on the brake, water must be turned on while working. Or the caseine may be removed by working alone, if worked twice. In speaking of removing all the caseine, I use dairy parlance, when, in fact, the caseine cannot *all* be removed by washing or working. In washing butter, it is very important that the water be of the same temperature as the cream while churning, or, perhaps, two degrees colder, in warm weather. Ice water is too cold. All sudden changes should be avoided.

If butter is kept at an even, cool temperature, it may be handled or worked very much more without injury to the grain.

Some experiments seem to prove that butter keeps better to *work* out the caseine rather than wash.

Some dairymen, also, think washing injures the flavor of butter, but I am not prepared to endorse that belief.

In handling butter, either in washing or working in the salt, great care is necessary to avoid a drawing or smashing motion, with the hands or lever, in order to preserve the grain and gloss.

The working can be done equally as well with the hands or on the well constructed brake, by one who has had experience. If butter is worked too much, it will be salvy and leaden; if not enough, streaked with white. The white streaks are not salted.

The amount of salt used must conform to the taste of the consumer. As a general rule, two-thirds of an ounce of salt to one pound of butter is sufficient, unless the butter is to be kept a long time, when an ounce or more may be used.

Ashton's and Onondaga salt are the best I know in the market, but manufacturers should give it to us free from dirt or sediment, if possible.

I have had no experience with any but spruce and hemlock packages. These may be prepared for use by filling them with brine, and allowing it to remain till the wood is saturated; then cleanse the tub and sprinkle in a little salt. The butter can be pounded down with a heavy wooden pestle; of course, it must be scalded and kept wet. Too much pounding will injure butter. If the face of the pestle is made slightly concave, it will help to leave the top of the butter in oval shape, giving it a good appearance. The external appearance of everything gives the first impression as to its value. To smooth the top of butter, a wooden paddle, well prepared, should be used.

The butter should be covered with a fine cloth, tucked down at the edges, on which should be carefully and smoothly spread, with a knife, a little very clean salt; not a pound or two.

If the cloth is left off for a few hours, till the butter has hardened, so the impression of the cloth will not show, it will shine better.

If butter is to be kept long, it is well to put on more salt, and keep the butter covered with brine to exclude the air.

If the butter is sent to market and used at once, it will look better to expose it to light, as it will change the color sooner.

Everything about the package should be neat and wholesome.

To keep the tubs looking new they should be stored in a dark room.

Butter is put up in a variety of forms, to suit the fancy of consumers, and the form in which it is sent to consumers sometimes adds very much to the price, and we all need to be looking for a good market. Great improvement has been made in the last few years in this branch of husbandry, but not over one-fifth of the butter made in Vermont is yet called "fine," or "fancy," or "gilt-edge," and we must not cry "Eureka" too soon, but call to our aid every means of improvement, and add to them some good, thorough thought and work, and the frequent complaints from buyers, that but little butter is what it should be, will not be heard, and we shall get more remunerative prices.

The Western dairymen are our competitors, and I can see no good reason why many of our markets will not be supplied with good butter from them, at less cost to the consumer than from the dairies of Vermont. We must excel them in the quality of our product if we would succeed.

DISCUSSIONS ON MR. FASSETT'S PAPER ON BUTTER MAKING.

AT MIDDLEBURY.

Mr. Douglas hoped the farmers present would ask Mr. Fassett questions, as he had information which could not be pressed into the compass of a brief paper.

Dr. Bond asked, what means could be used to regulate the temperature of the milk room.

Mr. Fassett spoke of the expensive one of having an ice room adjoining, and taking the cool air from that room to the milk room.

Mr. Douglas thought it made no difference about the temperature of the air, so long as that of the milk was right. This idea of regulating the temperature of the milk room was an old time prejudice, and, like many other prejudices, stood in the way of profitable improvement. It would astonish any man, as it had the speaker, when the results of slight improvements are figured out; the difference in value on the product of twenty cows would amount, at least, to two thousand dollars, between a dairy of average cows, and some dairies of twenty cows that are actually kept in the State.

Mr Douglas thought the old small pans were the best possible invention to injure the quality of the butter; the deep, large pans were much better to preserve it.

Mr. Fassett thought favorably of the large pans, but others were getting the best of results from the small ones. His own practice was in favor of deep setting.

Mr. Eells thought the white specks in butter were caseine, from the bottom of the cream pots or pails.

Mr. Fassett had no doubt but they were dried cream, as he had separated them, strained them through a fine bag-breaking them up into smaller fragments, and churned an inferior quality of butter from them.

Mr. Douglas had no doubt but the white specks were dried cream. Professor Collier had analyzed them and found them such.

After a discussion in regard to cooling milk, Mr. Fassett stated that he cooled his milk—but not too suddenly—to about sixty-two degrees, and kept it in a room as nearly as possible at the temperature sixty-five degrees, without water around it.

Mr. Douglas set his in water in wooden vats, in deep pails, and controlled the temperature of the water by ice.

Mr. Benedict set in much the same way. He thought sixty-three degrees about the right temperature; had found it best not to cool the milk too rapidly.

Mr. Fassett thought it important that the temperature should be kept as uniform as possible, from the time the milk is set until the butter is packed. He also stated that water around the pans was not used as generally in Franklin County as formerly, nor was it now considered essential.

AT SPRINGFIELD.

Mr. Hubbard asked Mr. Fassett for his opinion of the effect of the food upon milk.

Mr. Fassett replied that he had not experimented extensively, but he thought that the result of concentrated food was to increase the amount of milk, but not the quality. Turnips will not injure the flavor of milk, if judiciously and regularly fed.

Mr. Hubbard instanced a case of a dairyman who fed one-half bushel of turnips a day, and sold his butter for fifty cents per pound; but his practice was to begin carefully, with a small quantity, and feed very regularly. He thought the feeding of meal made a very decided difference in the richness of the milk.

Professor Collier called attention to the point of cleanliness insisted upon in the paper as being essential to the production of choice butter, since milk is so prone to absorb odors.

Good cows were also essential to the production of good butter. If the Legislature had the power, and would appoint a commission to kill off the poorest half of the cows, the State would be richer a year hence. Dairymen often sold their most profitable cows at a small advance from the average price, when it would be better to give the purchaser something to drive away some of the poorest.

In reply to a call from Professor Collier, Mr. Chapman responded by saying that in a dairy where he had kept an account of the receipts from all the cows, and tested the quality of the milk, the cow that had generally been considered the best proved the most unprofitable.

Mr. Fassett, in reply to a question, thought apples increased the flavor of milk, and were, probably, good feed.

Rev. Mr. Borroughs raised the question whether our native cows would not do as well as Jerseys if as well fed. From his experiments he thought so.

Mr. Whitmore thought the Jersey cows over rated. They were treated as pets, well fed, and thus made to return more than could be profitably expected by common treatment. A little Canada cow was as good a cow as he had.

Mr. Fassett thought some of the breeds were bred for a special purpose, and were more reliable for those purposes than our native cows. Experiments by the speaker had proved these breeds more reliable. Examples were given by Mr. Fassett to prove the superiority of the Jerseys, for the dairy, over our cows.

Mr. Chapman wanted the term *native* defined. All the so-called native cows showed some marks of the imported breeds, as they had all been bred from foreign importations at a very early day in the history of our country. Some extra cows, claimed as natives, were made up of crosses of foreign breeds.

Mr. Hubbard thought great improvement could be made by crossing up our native cows with foreign blood.

STOCK RAISING.

BREEDING FARM STOCK.

BY C. HORACE HUBBARD, OF SPRINGFIELD.

In the hasty and crude suggestions which I propose to offer for the purpose of opening the discussion upon this subject, of such momentous importance to the farmers of Vermont, it is my purpose to recognize the wide difference of principle which too often, perhaps I would be justified in saying *usually*, governs the breeder of so much of the thorough-bred stock of the country as is deserving of the epithet "fancy stock"—stock that is bred and trained with the object of gratifying the fancy of the amateur, and to be sold at prices far beyond its intrinsic value for beef, milk, or improving the common stock of the country, and that which must control the farmer whose aim is to rear stock that shall pay him the best income for the feed consumed and the labor expended in its care. The design of the breeder of the former class of stock is to produce animals which, in strains of blood, color, marking and "points," shall meet the popular demand, as it may exist at the time; while, on the other hand, the farmer is bound by every consideration that addresses itself to his desire for a reasonable income from his farm and stock, to his commendable pride in success, and to his self respect, to make *utility* the paramount object, and to disregard every temptation, however flattering, to make fashionable crosses which do not stand the test of cold matter-of-fact utility.

The office of all domestic animals, except such as are devoted partly or wholly to labor, is to convert the forage and crops of the farm into a more concentrated form of merchandise, at the same time that the fertility of the farm is sustained, and its productiveness increased, by the economical guarding and application of the residuum to the soil, in the form of barn yard manure. The digestive apparatus of the animal, together with the arterial system, by which the nutriment in the food is made to nourish the tissues of the body, all kept in life and motion by that most mysterious essence, nervous force, constitute the machinery by which this conversion is performed. The degree of success which shall attend the operations of the farmer; the profit or loss which he may compute at the end of each year; the means which he shall enjoy for giving to himself and his family those comforts and refinements afforded by our advanced civilization; the power to give to the wife who labors by his side, and who often bears more than her share of the burden of life, some relief from the exhausting, never ending round of cares of the kitchen, the dairy, the nursery and the basket of patches; the wherewith to educate his children so that they may play well their part in life; and to so live himself, and so train *them* that they will not detest their father's calling, and fly from the farm at the earliest opportunity; and the accumulation of a little surplus to meet the exigencies of sickness and declining years, *all* depend, to a very great extent, on the character of the machinery he employs to work the coarse productions of the soil into a finer kind and quality, and more marketable form.

A cow that has, in growing to maturity, consumed an undue proportion of the nutriment in her food in the manufacture of a large, coarse head, with a great pair of horns, and a coarse, masculine frame, which must be vitalized and warmed by food every day, or one that expends much vital force in roaming about the pasture, running and fighting, is not an economical machine. One that fails to draw the nutriment out of her food and make *anything* of it, may be a good machine to manufacture *manure*, but must be regarded as a *wasteful* one. The number of cows of the latter class in Vermont, is, I am convinced, enormous. The cow that converts too much of her food into bone, muscle, fat or nervous force, at the expense of the pail, is not possessed of a well balanced system, and will entail a loss on the dairyman.

The sheep that, having plenty of good pasture in the summer, and sweet, early cut hay in winter, yields a fleece of three or four pounds of wool, is not manufacturing her food to good advantage.

The pig that works off its excess of vigor and activity in tearing down its pen, cannot be a good economizer of food, and the horse with no more nervous energy than a pig should have, is a most discouraging subject to feed, drive, or write about.

The margin for the improvement of the domestic animals in the State is very wide. If all the animals that never should have been born, and that do not pay any profit, should be sacrificed on the altar of improvement, the slaughter of the innocents would be frightful. Not a few of the farmers would see the cows they have bragged over walk up and lay their submissive necks under the wheels of this Juggernaut.

The first step for the farmer to take, or, rather, the preliminary to any step, in breeding farm stock, is to fix and determine upon a well considered *ideal* as what he wishes to produce ; a standard that shall not be often nor lightly changed. Having formed in his mind the image of perfection to which he desires to attain, there are certain well established principles which he must observe. Principal among these is the law of similarity, that the qualities of the parents are transmitted to the children. This is a great and wonderful law, and he who perfectly understands it and is master of the power to apply it in practice can mould them at will. The size, form, color, temperament and other characteristics of animals, are at his control, and can be gradually changed and modified in a most surprising manner. It is a peculiarity of this law that the qualities of remote ancestors may lie dormant in the immediate parent, and yet be transmitted to the offspring in all their force and activity. It is the non-observance of this principle which occasions so frequent disappointment in stock breeding, and especially in breeding farm stock. The farmer loses sight of the fact that the character of the calf may be controlled by some dormant quality of the parent, that it may "trace back," as it is termed, to a remote ancestor; and he is surprised and disappointed, after years of feeding and care, to find that the heifer, which he expected would make, like its dam, a valuable dairy cow, proves to be only ordinary or inferior. The frequency of this and similar unfortunate results are the natural and inevitable consequences of what may be termed our homogeneous system of breeding, if the word system may be applied to anything having so little order. There are such variation and antagonism in the qualities of the numerous animals whose blood unites in the veins of the calf we raise, that it is impossible to predict, with any certainty, what qualities will be transmitted to it.

It is another peculiarity of this law, equally important, that each reproduction of any quality, by proper selection, intensifies the reproductive power as regards that quality, and makes its reappearance more and more certain in each generation. It is as if a great ball is set rolling down an incline just sufficient to give it motion. At first its movement is such that every inequality of the ground turns it from its course. As it rolls onward it gains in speed, and its momentum, which increases with every revolution, sends it spinning down in a line as unerring as that of yonder star, which holds its way, century after century, among its glittering companions, without deviation of the breadth of a hair from the path marked out for it by the Hand that leads us all.

There is no one word which expresses the idea I wish to convey so well as the word *momentum*. It is a property or power to resist and overcome opposing force.

Thus, if in breeding cattle, both sire and dam for many generations are selected from families marked for a large yield and good quality of butter, the certainty of obtaining good stock for the butter dairy will increase with each generation, until, at last, the variations from that character will be rare, and a family of butter cows will be established. The males of such a family will impress the same character upon other herds with which they are crossed. It is by virtue of this peculiarity of the law of variation that thorough-bred bulls cause such a uniform change in the characteristics of the common cattle with which they are crossed. Their qualities, whatever they may be, if they are really thorough-bred, have become intensified by long breeding, until they possess the power to perpetuate them with great certainty and uniformity.

I may as well give a few moments' consideration, at this time, to a question which I foresee will arise. It is this: Shall we, in breeding common farm stock, use thorough-bred males? My answer would be: if such males are from families that are really thorough-bred in the line of utility and usefulness, then, most emphatically, yes. If, on the other hand, they have been bred for fancy points, if the constitution and stamina have been impaired by close breeding and pampering, then, a *thousand times, no!*

I am very certain that close breeding cannot be followed for any length of time without a marked effect on the constitution. The development of the animal may be full and complete, with an appearance, under favorable conditions, of rugged strength, but there are likely to be an inherent sensitiveness and a delicacy which are objectionable. The form may be one of perfect symmetry, and every organ, so far as we can see, complete and strong, yet there is, under the fair exterior, a weakness or want of stamina, a very rottenness that needs only some exciting cause to set its destructive agency into fatal activity. And, unfortunately, it is a law of nature, that weakness is more certain of transmission to the young than strength, and bad qualities more easily produced than good ones.

As the prices of thorough-bred animals, of any race or breed, advances and a speculative tendency sets in, breeders are subjected to a strong temptation to seek to develop fancy points and to neglect real utility and usefulness. The animals are not allowed to give milk because it is desired to keep them in show condition.

The natural tendency is towards deterioration. If any function is not cultivated by breeding and training, it will be very sure to grow less in power and activity. The cow that is not milked loses the capacity to give milk, and transmits a tendency to the same incapacity to her offspring. I do not intend to reflect upon any particular breed of cattle or other animals, for the same thing exists among all. The Jersey breeder, who goes for a particular color of hair, horns, tongue or switch, hurts his stock every time. The Ayrshire breeder, who endeavors to imitate the lordly form of the Shorthorn, impairs the value of his Ayrshire cow; and the Shorthorn breeder, who, in breeding stock for New England, neglects to perpetuate and improve the dairy qualities for which that breed was once so celebrated, is doing an incalculable injury to the dairy interest. I have had, in my own experience as a breeder of sheep, some very marked illustrations of the general principles here enunciated.

At the same time that I advise the constant effort to develop the points of utility, I should fail in my duty did I omit to counsel a harmonious and well balanced development, and to offer one suggestion which I apprehend will be regarded as uncalled for, and which, I fear, no one will consider it necessary to heed. It is, to *avoid extremes*. I have seen the capacity to produce a large fleece of fine wool carried to that extreme degree, that the whole strength of the sheep was exhausted in growing the fleece, and there was no stamina left to reproduce its kind. The next generation was the quintessence of feebleness, worthless to the last degree. I do not know why a cow may not give so much milk as to exhaust all the strength of her system, so that the calf she bears may fail to receive from her the strength of constitution necessary to a dairy cow. I do not know where the limit should be placed, but I believe the principle to be sound, and call your attention to it, so that you may give it the consideration for which your business as dairymen affords the opportunity.

It is my belief that ante-natal impressions have a very marked effect on the calf or other young animal; that the cow that is called to exercise, in a high degree, the lacteal function during gestation and up to within, say two months of calving, is more likely to produce a good milker than if she is half dried off early in the season. I think the temper of the calf is modified by the quiet or uneasy condition of the cow. A curious instance, as it seemed to me, of the effect of a shock to the nervous system of the cow on the unborn calf, occurred in my barn. A cow, five months in calf, was slaughtered for beef. The little, perfect calf, in its mother's womb, was found to have the blood congested in the center of the forehead, at a point corresponding to the spot where the poor mother received her death blow. Domestic animals should be treated at all times with gentleness, and sufficient firmness for good discipline, and no more.

The relative influence of the parents in determining the character of the young, depends, in my opinion, largely upon the degree to which the qualities of each have been fixed and intensified by judicious breeding, as before alluded to, and on their comparative vigor and stamina. It is thought by some writers on the subject, that the male parent exercises a controlling influence in the external form, covering of the skin, and the locomotive powers, while on the mother depend the vital and digestive functions. This rule must, I think, be accepted with a liberal allowance for circumstances. It is certain that the sire exercises a marked influence over the character, as a dairy cow, of the young.

It is not enough that one parent possesses the qualities it is desired to perpetuate. Both must have them, and both must be descended from families that exhibit them. Then the character of the issue is measurably certain.

I regard it of the highest importance to cultivate hardiness of constitution, for that lies at the basis of success.

There can be no doubt that early maturity is desirable, for a year saved is a year gained in profit.

As I have before intimated, a great digestive capacity in any animal, except, perhaps, the horse, is absolutely essential, and the breeder or farmer must keep that rule constantly in view.

The rule that the animal that makes the most of the food it consumes is the best, must be enlarged. The animal that makes the best use of the food consumed is good, and the one making such use that *consumes the most*, is the best and the most profitable.

WINTER MANAGEMENT OF NEAT STOCK.

BY L. C. FISHER, OF CABOT.

When God created the universe, He gave man dominion over all the cattle which He had made. In His infinite wisdom He so constructed the soil of the earth, that, with the aid of the husbandman, it might bring forth food for the support of man and beast. In our Northern climate, where the winters are so long and severe, we are obliged to furnish shelter and much food for the support of our stock, at least six months of the year. It has been fully proved that animals fed upon one kind of food alone, for any length of time, will not thrive. To have healthy and well developed animals, it is necessary to have a change and variety of food.

The seed time is the time to prepare the winter food for our stock. The root crop should be made a specialty; at least one acre of land to every fifteen head of cattle, should be devoted to this purpose. My experience is that the turnip crop is the most profitable of any. Then follows the grass crop, which should be secured while it *is* grass and not hay seed. Stock should not be kept to kill brier bushes and thistles in summer, and convert straw into manure in winter, but *kept* for *profit*. And this comes only by good breeding and good care the year round. After the above named crops are secured, then comes the winter management of stock.

The same rule applies in keeping stock as in all kinds of business. If it pays for keeping at all, it pays to keep it *well*. When a man commences right, and keeps on in that direction, he ends right. And when a man commences the winter right with his stock, and keeps doing for them, they come out looking well in the spring. My practice is to commence feeding the tops of my root crop in October. After they are gone, it is time to feed out of the barn. I feed the best I have to all kinds of stock when they first come to the barn; the change is so great from green to dry feed, that they need good feed and good care, especially the young, growing stock. Here is where a great amount of money is annually lost. My method of feeding is as follows: After milking is finished, give a feed of nice hay (or rather dried grass), and then a feed of roots and shorts or meal; immediately after this is eaten, commence to water; then another feed of hay or straw, as they will then eat the coarsest food best; let them remain quiet for six or seven hours, then water again, and feed with hay or oats on the straw, which is a good practice, followed with a little meal or shorts, which is the last feed for the night.

Without holiness no man can see the Lord—and it is just as true that without cleanliness no man can have *neat stock*. The mangers are as essential as the dishes on our tables, and should be cleaned at every meal. Also the stables should be cleaned three times a day, at least. Salt should be kept where the stock can get at it at their leisure. Air, light and exercise are very essential, but not too much of the former. Prepare some good, light, comfortable barns for the stock, and keep them warm.

Lumber is very much cheaper in Vermont than fodder. Hence the need of making our barns warmer to save feed. How many there are who keep their stock in cold barns, with no roots, no meal, no bedding; and when the cattle get up in the morning, the juice will drip off them, from their briskets to their rumps, and the remainder of them is covered with vermin, two lice to one hair, and three nits to one louse. If they survive the cold winter, they will not get their old coats off till the middle of the summer, and will take the remainder of the season to get to thriving. Such animals will sell very low when put upon the market. The owners of such will toast their shins by a fire made of green wood, or else you will see them around the stores and shops with their hands in their pockets, half way to their elbows, sucking an old, black pipe, complaining of hard times to get money.

But few people know how much profit there is in breeding and raising good stock. For instance, let us take a well-bred calf, when taken from the cow, at two days old, and learn him to drink his own dam's milk for a few days, and then put in a part skimmed milk, twelve hours old. At ten days give it twelve hours skimmed milk; at fifteen days, twenty-four hours; at two months, thirty-six; at three months, thick milk, with what dry shorts they will take. As often as once in six weeks, dissolve a lump of saltpetre as large as a robin's egg in the milk. With plenty of milk, shorts, early cut hay, water and exercise, a calf can be grown from two to three pounds a day for a year. With this start, you can make almost any sized animals you wish.

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After Mr. Fisher's paper, a lively discussion sprang up on the value of different kinds of feed for stock, more especially of roots. The diversity of opinions on this very important subject, gave additional force to the suggestion of Mr. Pitkin, of Marshfield, that an agricultural experiment station was necessary to settle, beyond dispute, these questions.

THE HORSE.

BY DR. J. B. ORMSBY, OF BRADFORD.

AN ABSTRACT.

* * What would be the effect upon mankind were they deprived of the horse? The mere asking of this question brings vividly to the mind the great importance of the subject. In all ages the horse has been the most constant, and the most valuable servant of man. In war or in peace, in barbarous or enlightened, in civilized or half civilized, or in the savage states of society, we find the horse associated with man as his best servant.

It is not a matter of wonder, then, that almost every nation should have had grown up with them a race of horses peculiar to themselves.

The Arabians, on their broad and arid plains, leading a nomadic, tent life, with a warm climate, subject to sudden emergencies of depredation, or tempted by revenge or hope of plunder to strike a blow upon some neighboring tribe, have developed a race noted for astonishing agility. While the Cossack, amid the mountains of Northern Europe, where short summers and long winters necessitate a life of toil and exposure to the vicissitudes of a vigorous climate, where hard fare, long terms of fasting and severe labor, have produced a breed of horses as different from the Arabian as there is difference in the locality. England, too, has brought into being a horse characteristic of her people. To compare the monster English cart horse with the lithe, agile barb of Arabia, cannot fail to bring to mind the description given by the Scottish poet of the contrast between King Richard, the Crusader, and Saladin, the Saracen Monarch.

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While we see, in all parts of the world, these local characteristics, dividing the animal into so great a variety, we can but question ourselves as to what character of horse do our climate and local interests demand. Have we use for large team horses, to haul lumber, minerals or merchandise to or from market? Do we need, or have we inducements, to breed to the track? Is it profitable for us to endeavor to make the attainment of a 2:40 or a 2:30 gait an accomplishment to be attained at whatever cost? For what character of horses have we the best market? Ask Mr. Hunt, who comes to us from Abington, Massachusetts, near a dozen times a year, and who, in the last twenty years, has paid for horses, in this section, over twenty thousand dollars; ask him, I say, what kind of horses he most generally seeks for. They are not selected for their great speed, but solid, close built, trappy, hardy horses. He looks for horses of all work; good on the road, good at the plow, good wherever they are put.

As to the history of the New England horse, I can say but little. We know nothing of any animal of the horse kind indigenous to the country before the white people came here. But horses have been brought in from three principal sources, the English, the French and the Spanish. To the north of us, we have a mongrel breed of what are called French horses, a combination of the Norman with other stock common to the country; while at the south, are the Spanish reliques of their early importations. Intermediate between these two great types are the horses of New England.

Situated as we are, in one of the best climates for the development of muscle and frame, why should we not have a type of horses with as world wide a reputation as is the odor of sanctity of Plymouth Rock, and the fame of our New England teachers?

Vermont has deservedly obtained a reputation for her excellent horses. The fame of the "Morgan Horse" is almost world wide. It would be a waste of time for me to give the pedigree of that noble race. It is so well known that almost any school boy can repeat it. The two barbs, "Ranger" and "Bassorah," one from the head of the Persian Gulph, brought in 1819; the other, a windfall through accident, coming to this country when he was destined for England, from the Emperor of Morocco to an English officer who had rendered him some service. These horses prepared a stock that, when met by the later importations from England, of whom Wildair is a representative, or his foal, True Britton, who, by the fortunes of war, is separated from his master, Gen. Delancy, and made to mate with what his aristocratic blood might have taken as insulting to his high lineage. * * * * * * * * *

Thus was our Morgan produced, by a mixture of the high and the low, each side having in their veins blood of noble ancestry. There are those here who remember the early Morgan horse.

After the first three of the family had served their time, what has been the history of their progeny? Did they transmit the excellent qualities of their noble progenitor? or, should we expect it? Accidentally there arose an Alexander and a Napoleon; but have they left a race of world conquerors? * * * * * * * *

Though we may have no representative of the old, true Morgan, yet who can say that we have not a better grade of horses than if we had not had him? * * *

The farmer, here in Vermont, should consider for what purpose he breeds. How can he make horse power more profitable than ox power? The risk is certainly less with oxen than with horses. Oxen can always be turned off for beef, while if any accident should happen to a horse, his sale is injured materially, if not destroyed. But the man that begins on a farm to-day, young, just starting in the world, lately married, is in no such condition as his grandfather was. The young farmer, in these days, must have a silver plated harness, a two hundred dollar buggy, and a splendid set of coon skin or wolf skin robes; then, when "*fair time*" comes, a 2:40 or a 2:30 horse. * * * * * But the question recurs, what is the most profitable style of horse for the farmers of Vermont to produce? Have we not, through the temptations held out by our agricultural fairs, produced too much of a rivalry for fast horses? breeding too much for the track? Do we not rather want a horse of all work, of medium size, compactly built, of good mettle, but still docile? * * * *

* * That horse is of the most service to man, which combines, in the highest degree, his most excellent points, no one overriding the others. The race course has its uses, but all competition should not be confined to speed, neither should all the care in breeding be confined to the sire. The dam, I think, is too much neglected. True it is, too, that great care should be exercised in regard to her first mate. Having a good mare, be sure her first foal is from a good choice of horses. Otherwise, her future progeny will be marked by the defects of the first. * * * *

HORSES FOR VERMONT.

BY ALBERT CHAPMAN, OF MIDDLEBURY.

INTRODUCTION.

It would not cause any great strain of the memory of those now before me, to remember the time when Vermont horses had the very best reputation of any raised anywhere, and the Morgan blood was sought after in all sections, as the best from which to raise horses suited for those uses that demand a high type and pay the most remunerative prices, and many present will remember when stallions raised in this town, and having this blood, brought much higher prices than can probably be obtained for any now raised here; and, as it is very important that horse raisers in Vermont should find, if possible, some reason or reasons for the existence of such a demand for Morgan horses in times past, and why the decline in demand has produced a different state of affairs, and those who raise horses in Vermont do not now realize as high prices for them as formerly. This, with the fact that Vermont farmers, being differently situated from large stock raisers in the West and South, cannot profitably pursue the same course in breeding, or raise the same kind of horses for their use and for market, makes the standpoint from which Vermonters must view this question very different from that of breeders elsewhere; although, from the facts I shall present, I hope to be able to convince you that Morgan horses are now, as they have been, the best for not only Vermonters, but for others, and that they still bring the most remunerative prices when carefully bred, and are sold on their merits. A number of years since, the subject of bringing in large, coarse stallions to improve our Vermont horses was brought up and ably advocated by a gentleman who resides near me, and we had a discussion of the same through the public prints. Since then, I have been closely observing the effect produced by the cross, and I find no facts in this experience to shake my confidence in the soundness of the position I then took. But I find the more I look up the records of time and sales, and the wonderful effect the Morgan blood has produced upon other horses, the more I feel my position on this subject impregnable, and the more I am anxious that all Vermonters should understand this matter fully, and take such action as will secure the best results, and enable them to reap the largest pecuniary reward from their horse breeding. You will pardon me, then, gentlemen, if, in considering what are the best horses for us, I may take more time than is usual in presenting a subject before such a meeting as this, for, so long as the horse question must inevitably be one of absorbing interest to Vermonters, it is important that they breed the best, for those must be *the*

HORSES FOR VERMONT.

In discussing this question, therefore, I propose to notice the wants of Vermont farmers, and the kind of horses those wants most nearly demand, give some reasons why Vermont horses have stood high in market; why the blood, when crossed upon other races or breeds, has produced such great improvements; the influence it has and is exerting upon the trotting horses of the country; why their reputation was not kept up to the highest standard; show that it was not for want of excellence in the horses, but from the clamor of parties interested in other horses in part, but more to the fact that Vermonters have not properly appreciated the situation, and the excellence of their own horses; and then make some enquiries about the best course to improve the horses of Vermont, make their breeding most profitable, and their reputation, as it once was, better than any others.

It is evident, in the beginning, that the Vermont farmer cannot have a variety of horses, each adapted to some special use or work, and on very few farms of the State can horse breeding and raising be made a special, separate and paying interest. The average Vermont farmer must make his horse raising and interest dependant upon other branches of his farming, and upon his own use and work. He can seldom keep one team for driving on the road, and another for his plowing and other heavy work on, and for the farm. His wants emphatically demand the horse of all work, as he will have all kinds of work to perform. The farms in most sections are hilly, and the roads through those sections are, for the most part, not very level, to say the least; the soil is constantly changing, and often quite full of stones; therefore, the horse that constantly travels over such roads should possess many good qualities besides an easy, rapid road gait. This constant, continued shifting of strains and positions, as the travel is up or down hill, as the load is alternately drawn up or held back, makes a well settled, firm set of limbs, and hard, enduring muscles necessary, or this strain will soon render them unsound. His feet must also be good, compact, hard, not flat and soft.

This horse, that has such multifarious duties to perform, must be of medium size. If he is too large, the travel up and down our hills, at any gait Vermonters will be satisfied with, will soon shake him to pieces. He must be medium in height as well as weight. Sixteen hand horses may be all very fine to talk about, perhaps to sell to some parties, but they cannot, as a class, endure the road at a lively pace, with horses of a hand lower measure, especially in a hilly country. I am perfectly aware that many will not agree with me in this, and may, perhaps, be able to instance some xamples of tall horses that have followed the road and lasted well, but I have lived in various parts of our country, and I think I run no risk in offering to find three horses, under fifteen two, that are now sound, after years of hard driving, to every one some one else will find over that height, that, after performing an equal amount of service, has come out sound.

Another very important qualification of the Vermonter's horse must be a good, kindly disposition. While he should be a willing, quiet, peaceable worker, he must not be a lazy dolt, or the requirements for a good road horse will not be answered. Although quite as many farmers' sons as is desirable are becoming professional trainers and breakers, still it is, perhaps, quite as well that all cannot be; and so long as so many of our horses have to be broken and driven by farmers and their sons, who are comparatively unused to this work, this item of disposition is one of great importance, and one which we shall refer to more fully under another head.

Another requisite for the Vermonter's horse is early maturity, or, at least, the ability to perform much of the work of the farm while he is growing, maturing and becoming fitted for market, without breaking down or becoming unsound by such use. And, lastly under this head, Vermonters should raise such horses that, as they arrive at maturity, will bring good prices in market; and the nearer they come to gentlemen's stylish driving horses and fulfill the other requirements, the better, and the more they will bring. What I would define as my ideal of a gentleman's driving horse, is one of medium size, well proportioned, clean, flat limbs, strongly made, but not coarse or gross; good color, bay, brown, black or chestnut; he should have a good, easy road gait, that will take along a buggy, with two men in it, a mile in four minutes, ten miles in an hour, or from sixty to eighty miles in a day; with a courageous, free disposition, that will not require more work to get this performance out of him than it is worth when you get it. With all, he should have a bottom or endurance that will not make it impossible to sometimes repeat these performances, and enable him to perform a reasonable amount of driving every day. With all these, a good, kindly disposition, free from all tricks or vices, is indispensable. Any horse that possesses all these good qualities, is worth any where from three to five hundred dollars; and the more beauty and style in performing this work you can combine in them, the more can be added to the prices, with a reasonable expectation that the draft will be honored. Some of these qualifications may be dispensed with, and still we can have an excellent, serviceable animal, that will make a good horse for a physician, the express, the street cars, or various other uses that may be named, and a horse that will bring money enough to make his raising profitable, especially if he has worked sufficient the last two or three years he has been kept on the farm to pay for his keeping during that time. While we may dispense with some of these, and still have a horse that will bring a remunerative price, there are others that we cannot dispense with and have a horse valuable for market, or that will bring a good price, except through some jockeying or trickery, whereby his purchaser is defrauded.

A horse may have a fine form and beautiful color, but if he has not a good gait, good courage, is ill tempered or tricky, the man that buys him at any price that will pay for his raising and breaking, will be cheated. And this brings us to the consideration of our second head.

The reason Vermont horses have stood so high in market, is because they proved more useful and lasting in a greater number of positions and kinds of work, than any others; and while they were more successful as horses of all work, more of them were up to the standard of a gentleman's driving horse than any others, and so great became their reputation, that horse breeders made long journeys from States more or less remote, to purchase stock horses of our best, with which to breed up and improve their own blood, and very rarely were the expectations of such breeders disappointed. I think I run no risk in saying that the representative Morgan stallions of Vermont have been more successful, as sires of horses useful for a great variety of purposes, when crossed upon almost all kinds, than the stallions of any other breed or race of horses. To use a phrase common among breeders of horses, the blood of the Morgan happily and successfully nicked with the blood of nearly all other races or breeds of horses. And why? One great reason is, that if not always of medium size, he was a representative of a medium sized race, and, therefore, when crossed upon other breeds, there were no great differences in size to be bridged over, and a valuable rule of the true breeder was not violated; that is: in crossing never unite too great extremes in size, especially when the sire is larger than the dam. And here let me mention a rule that the breeder of any kind of stock will do well to heed: The male of medium or less than medium size, will get stock of greater uniformity and excellence than the male of larger size than the average of his breed or race. While the large sire will occasionally get an offspring of unusual merit, there will be a want of homogeneous quality in many others, and the average of all will seldom be found very high. This all breeders of experience understand, and a large sire is seldom used by them except to make some point in breeding, having in view some object or improvement in the future, rather than to get the bulk of the stock to be raised for present profit. This, although seemingly a digression, illustrates one reason for the success of the Morgan stallion in crossing upon other horses. Other reasons were: he was usually a compact horse, a stylish, easy traveller, with a tractable, kind, but courageous disposition, and with great powers of endurance. With all these, he possessed such fixedness of type as to enable him to impart these good qualities, in a great measure, to his stock. As among other kinds, there were poor ones, and, like all genuine merit, he had his counterfeits that were palmed off for the genuine, to the great injury of the reputation of the true. But the better specimens of the genuine Vermont Morgan seemed to improve almost all kinds of horses upon which he was used as a cross. To the aristocratic thorough-bred he gave substance, flattened out his limbs, drawing down his hocks, and giving him a make and form that made it possible to get the best trotting action; a kindly disposition that made it possible to work him with some comfort, without taking aught from his spirit and courage. In short, the cross gave animals that could be put to some use besides beasts on which to expend money fitting for the race course only to be disappointed, in nine times out of ten, after they had been fitted, and leaving their owners with a lot of unsound pests, of no use except to perpetuate their own profitless, worthless race.

I would not speak disparagingly of the best thorough-bred horses, from which we have derived some excellent and valuable strains of blood, but I must be pardoned if I cannot appreciate the value of the most aristocratic thorough-bred blood, after it has flowed through the veins of half a dozen generations of unsound animals, who had given out and broken down upon the race course, or even in common use, for, talk as much as you please of the endurance of the thorough-bred horse, the average Morgan will endure an amount of every day work for years, that will soon use up and render unsound the average thoroughbred. Blood will tell, no doubt, and I should fear, if I bred to a thoroughbred stallion, with long, round, unsound legs, a high-strung, irritable, vicious disposition, I should find I had a colt that was skittish, that, after I had got him harnessed, would not want to wait until I was ready to go, and, after I had got ready, would look around at me with an assurance that *he* was not then ready, and, if I had much of a load for him to draw, would not be ready, anyhow; for drawing loads, and such like useful work, was not what he was made for; and, if I persisted in exacting it of him, he would break down, as his illustrious ancestors had done before him. To expect a horse, useful for all work, to result from breeding to one bred and used for ages for the one special purpose of *running* a mile, or even four miles in a very short time, and at a gait almost never used in every day, useful life, is about as sensible as to expect a mastiff to spring from the loins of a rat-and-tan terrier.

In England, if they want a horse to take his master over fields, hedges, fences and ditches, to endure the fatigue and perils of the hunt, they do not take the unmixed thoroughbred, but cross him out on to something with more substance and strength. Blood will tell, no doubt, but is it not more sensible to make it tell in perpetuating good, useful qualities, instead of handing down useless, or worse than useless characteristics? The great value of blood cannot be disputed successfully, but it may prove a curse rather than a blessing; it certainly will if it is not used with caution and judgment. And here we find the great value of the Morgan blood. There was not only enough of it to assert and engraft its characteristics, descending, as it did, from Arabian blood, but it had, for generations, flowed through the veins of animals that had been used for practical, active, every day work, whereby all their parts had become strong and durable; not overstrained or vitiated by some occasional extraordinary performance; consequently it followed that its introduction proved a practical benefit. It not only gave the above desirable improvements, when mingled with the blood of the thoroughbred, but when it was united with the heavy, cold, spiritless Canestoga or Pennsylvania horse, scattered over so much of the West, it quickened it into life; so that the animals resulting from the cross, with much less dead weight, possessed much more nervous energy and power, and a free, open, easy gait, and a proud carriage; in fact, giving horses that were much increased in value, and adapted to such uses as demand a higher type, and much better remunerate the raiser.

Another race of horses that has been crossed very extensively with the Morgan is the French Canadian, a race made up of a number of different elements. This horse, though not an exalted idea of a driving horse, or even of a horse of all work, has, nevertheless, some excellent qualities, one of the chief and best of which is, great hardiness. For generations his ancestors have been taught that to exist at all, they must live under many and discouraging difficulties. While young, his short summers have been spent among pastures hardly fair, large or luxuriant, and his long and terribly cold winters among deep snows, with a scanty keep of not very nutritious fodder. At a very early age he has been taught by practical experience that he had inherited a lot of severe toil, for which he must not expect much return, in the way of care or generous keep; and if he thrived at all, thrive he must on poor fare and neglect, and be exceedingly thankful if he escaped positive, brutal abuse. To many of his race, also, came the lesson that whatever he was commanded to do he must do or die, no matter how inadequate he was made by nature for the task imposed. Although small and seemingly not strong, yet by fear of being mauled to death if he did not, he was compelled to haul loads that to the larger and seemingly stronger thorough-bred, would be immediately refused as unreasonable, and, to him, probably impossible.

The result of the cross of the Morgan upon this Canadian has been a great improvement to the Canadian, as he had but little to impart and everything to receive. His great hardiness did not exceed that of the Morgan; therefore he had nothing to give, that was desirable, that the Morgan did not possess. There is another strain or peculiarity among these Canadians, that seems to nick well with the Morgans, or any other race possessing the trotting instinct. Many of these are pacers; and when pacing mares of this race are crossed with the Morgans, or other trotting horses, the progeny are apt to prove fast trotters. This result, which is a curious one, i. e., producing trotters from pacers, is attracting much attention from breeders at this time, and is giving some very remarkable results. Smuggler, who won the great Champion Stallion Stakes, at Boston, in 1874, was bred from pacers, so far as his ancestors have been traced. They, for several generations back, were confirmed pacers, and it will be interesting to see what the result of breeding from him will be. Mr. Wallace gives it as his opinion that a large proportion of his stock will be pacers.

Young Pocahontas, for which Mr. Bonner gave a promising son of Rysdyck's Hambletonian and $35,000, was out of the pacing wonder, Old Pocahontas, by Ethan Allen. The dam paced in 2:17, if I remember aright, and the sire trotted his great race, with a running mate, in 2:15. The progeny from this cross (Young Pocahontas or Nemon) is one of the fastest trotters, as well as one of the most beautiful ever bred. I believe that at the time Mr. Bonner purchased her of Mr. Bates, he paid the highest price ever paid, up to that time, for a trotter.

We will now consider another class of horses. Their blood, or characteristics, are not so clearly defined, or so uniform, as either class heretofore mentioned as having been crossed with the Morgan. I refer to the trotting families. Probably the blood of no one horse is so generally found among these horses as the blood of old imported Messenger, and, no doubt, is often claimed when it does not exist. These families are so various, and there are such varying characteristics among them, that it is impossible to describe them as a class. Embraced among these families are all sizes, colors, tempers and builds. Often in a single subdivision or family will be found almost as great a variety of animals. Some make most excellent horses of all work, some make excellent carriage horses, saddle horses, team horses. Many of them can be used for a variety of duties. A few make very fast trotters, many make good driving horses, and a great many are animals neither useful nor ornamental, and pay but a very poor return for the cost of raising and breaking.

Now I propose to make a claim that will be regarded by many as very doubtful, and by many more as very absurd. The claim is this: When mares of these families are bred to first class Morgan stallions, the average progeny resulting from this cross is a great improvement on the mares, or what the foals from the same mares would be if bred to stallions not having the Morgan blood, say of their own kind or blood. I will not here for a moment contend that among these Morgan foals will be found more fast colts, or that any of them would prove to make shorter time than some of the foals in the other case. But what I would more especially claim is, that while I do not believe the Morgan blood would lessen the chances for speed in those that would prove fast, it would add vastly to the value of those that would not prove fast, making them more useful, with better dispositions, better fitted for a variety of uses, and capable of enduring more hard, every day work and service, and worth higher average prices than those not having that blood. I know that on the chances for speed I shall be disputed by many, but upon this point I would remark, that after looking the matter over and comparing the results of the cross of Morgan blood, I have not a particle of hesitation in stating that in every case the cross has been made, even upon trotting families, there has been an improvement in the traveling or roadster qualities of the offspring, and that the average trotting quality or speed has not been diminished.

I have been at some trouble to look up some facts upon this point, and, although my means of obtaining the information have been very limited, still I have been able to satisfy my own mind fully upon this subject, and I only regret that I have not had time and means to more fully develop these facts, and, especially, to arrange such as I have already collected, so as to give them their full force and weight.

But I have been able, with even very limited time and facilities, to trace the pedigrees of over one hundred horses that have made their mile in 2:30 or better, through Morgan sires uninterruptedly to Justin Morgan, and it has not always, or nearly always, depended upon the trotting blood or instinct of the dam, that the colt has developed speed. Now notwithstanding the immense amount of prejudice that has been created against the Morgans, by entirely unjust distortions of facts, by misappropriations of meritorious performances, and by downright, shameless unfairness every way, the fact cannot be done away with, that horses of Morgan descent are fast trotting themselves back into public favor and compelling the respect of some of the best judges, as well as of the public generally.

Mr. Wallace, in the last volume of his pedigrees of trotters, is obliged to say that the Morgans are increasing in favor, and, although he cannot so far overcome his prejudice as to class them fully according to their merits, still they have evidently compelled him to treat them with more attention than they have received before. I do not wish to claim that in any respect Mr. Wallace has intentionally done the Morgans any injustice, but, from his education and standpoint, it is impossible to get rid of his prejudices at once, and I have no doubt but the honorable fairness of the man, and the persistence of the Morgan trotters, will, in time, give them their true position in the mind and records of not only Mr. Wallace, but of all other truly honorable gentlemen.* I will, at least, promise any one that will take the trouble to investigate all these facts of records and pedigrees impartially, that their admiration of the Morgan as a getter of trotters will be measurably increased, and the conclusion will be reached, that if the Morgan blood does not confer the trotting instinct and power, it at least furnishes the key that unlocks it when it lies dormant in some other strain, and confers many other excellent qualities that are very valuable, not only in trotters, but in horses for a variety of uses. One fact that will stand out very prominent in these investigations will be the large number of sires of Morgan descent that have got 2:30 horses. I have been able to trace, with a very tolerable certainty, over seventy, and, from the difficulty in getting at the facts in regard to many of those whose pedigrees I have cleared up, I am convinced that there are many more among the unknown (or among those that are set down as unknown,) that will prove to be Morgans, provided their origin is ever established.

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* Since the above was written, Mr. Wallace has commenced the publication of a very excellent magazine called WALLACE'S MONTHLY, and, in the very first number, October, 1875, in a very fair article upon the trotting meeting at Cleveland, in 1875, I find the following: "And from Justin Morgan, foaled in Massachusetts, in 1793, and his descendants, there has slowly evolved a race of trotters, that have gradually improved, every year, in courage and speed, till now they are the dangerous rivals of *all* the best performers on the turf." I particularly invite all to read the article, as one that sustains the arguments I have made in this paper to prove that Morgans are trotters, and that medium sized horses are fastest and most durable.

Another fact that appears is, that this speed is developed over a very great extent of country. It is very far from being local. Another is, that it sometimes appears to be developed from the cross upon families that have not shown speed when bred to any other stallions. A notable case of this is the production of Golddust by Vermont Morgan. Another fact, that will appear in making these investigations, is the pains that have often been taken, by names and otherwise, to cover up the fact that there was Morgan blood. This has arisen from two causes. One has been a desire on the part of a class to depreciate the value of Morgan horses, and rob them of their true standing, with a view ot making capital for some other kind in which they might have a pecuniary interest; the other cause is the cowardly willingness of some that owned Morgan blood to sacrifice their birthright and just fame for the mess of pottage contained in the pecuniary advantage they might obtain out of a public sentiment created by unfair representations.

In looking out those pedigrees, a Vermonter would naturally pass by such names as Hoagland's Gray Messenger, Green's Bashaw, and Taggart's Abdallah, not expecting that horses having such names would have been likely to have been sired by Morgan stallions. Yet they all three were. How many more such cases there may be I have not had time to discover; these three were exposed to me by accident.

I would like to notice another fact in the developments of time recorded for a number of years. While it is claimed that the Hambletonian family are furnishing the very fastest trotters, or most of the 2:20 class of horses, the Morgans are sending some into that class also; and the fact of the Morgan blood in the dam of Gloster has not prevented this grandson of Hambletonian, through Volunteer, from making the best time yet recorded to the credit of any of that family. While on this Hambletonian track, I cannot refrain from making another comparison on this point. It is claimed that this Hambletonian blood brings down more of the Messenger trotting blood than is brought down through any other source. I think it will be fair to trace the history of two horses and their descendants, as likely to throw a little light upon this subject. And for such horses I will take the Harris' Hambletonian and Hill's Black Hawk. Both these horses stood for years in the same county, and both have reason to be proud of their reputation as sires of trotters. I find that while Black Hawk has at least sixty direct descendants, through nearly forty sires that have made a record of 2:30 or better, Harris' Hambletonian has not near half that number. Now after allowing for the credit that is due to Harris' Hambletonian for siring many of the dams of these trotters by Black Hawk and his descendants, we must accord altogether much greater credit to Black Hawk for transmitting trotting power to his stock; and any one who has lived in the neighborhood where both horses stood knows that for general purposes the stock of Black Hawk matured earlier, broke more kindly, and more readily adapted themselves to common, everyday uses, than the stock of the other; and, in another particular, were much less liable to be unsound and defective in their feet and limbs than the others.

Here I would like to call attention to the history of another large, fine horse, out of one of these trotting families, and compare his record with that of Black Hawk that we have just noticed. Many Vermonters will remember the contest between Black Hawk and Morse Gray, in September, 1847, at Saratoga. While that contest did not develop any very low time, and was not, of itself, remarkable, it will readily be seen by reference to the history of the stock of both horses, that the Morgan blood has perpetuated more trotting power, by far, than has come down from the Gray.

I will make another comparison of horses that came upon the stage a few years later. It will, perhaps, be remembered that a large, coarse, bony stallion, from one of the large trotting families, was brought from New York to Whitehall or Ticonderoga, to sire trotters, those engaged in this enterprise contending, at the time, that the stock of Black Hawk, although fine appearing, smart travellers, were not fast enough to satisfy the demand for fast trotters. Many will also remember how Ethan Allen, then less than three years old, taught these theorists that if they were not as fast as they desired, one of old Black Hawk's colts was too fast for their favorite.

A comparison of the stock of these two horses will prove that the Morgan blood has not proved any more detrimental to the stock, so far as transmitting trotting qualities is concerned, than it did in sending Ethan ahead of Emperor, on the occasion referred to.

From these facts, and a few others which we shall name, we think we shall be justified in claiming that the Morgan blood, instead of lessening the chances for speed, decidedly increases them. The records of the season of 1874 confirm this view. One Vermont stallion, of Morgan descent, has four colts that scored better than 2:30 that season, and these do not include at least one that had made such a record before. A son of his has at least one that beat that time during that season. Camors, a son of General Knox, after making a better record than 2:20, was sold for $20,000 and taken to California, but, unfortunately, died there, before he had time to gain additional laurels for himself or family; but his half sister, Lady Maud, is more than making his place good. Her performance at Rochester, last August, where she beat Judge Fullerton, in three straight heats, in 2:18¼, 2:19½, 2:18¾, drew from the *Spirit of the Times* the following compliment: "Her three heats, below 2:20, the first time the feat has been accomplished this season, excepting by the Maid, at Cleveland, stamps this daughter of General Knox as one of the greatest of living trotters."

Lucille Golddust has also trotted better than 2:20. The full list of the 2:30 horses of 1875 is not yet fully completed nor classified, but when it is, I think no friend of the Morgans will be ashamed of the number there recorded that have descended through Morgan sires. The number of Morgans in the list of 2:30 horses for the season of 1874 was a surprise to me, as it was to many Vermonters, and certainly to many others. The friends of the Hambletonians claim that twenty-six of their favorites trotted in 2:30 or better, in 1874. These twenty-six were sired by eight different stallions. Against this I have been able to make up a list of thirty-four Morgans that trotted in 2:30 or better, in 1874, and these were sired by twenty-eight different Morgan stallions. This last fact I consider a very important one, as it proves that the speed quality is universal among the Morgans, and is not as much confined to a few particular families or sires, as among the Hambletonians. I also think it indicates that the chances for speed are quite as great when breeding to Morgans as to Hambletonians.

I would now like, as briefly as possible, to show a few cases to prove a position taken heretofore in this paper, and that is in regard to unfairness towards Morgan horses, in not giving the full benefit of their meritorious characteristics and performances. The first case I shall name is the persistent effort of the New York *Spirit of the Times*, and other parties about New York, to keep them in the back ground, and not give horses of this blood their true positions when they had won them; and in this I claim that they have shown more disposition to sustain their own theories and favorites than they have to record facts, and, in some instances, to absolutely steal credit that belonged to that blood. The first instance I shall name is that of Flora Temple. I have no means of showing absolutely that Flora was of Morgan blood, but, to me, the probabilities are very strong that she was. In the first place her sire, at one time, had Morgan attached to his name. I cannot now recall exactly how, but I believe his name was Hunter Morgan; if not, it was Morgan Hunter; either way the name, as applied, was indicative of Morgan blood. If there is absolutely no foundation for this theory, then there must have been Morgan blood in the dam, for any one that will find a picture of her in late years, since she has been breeding, and has not had her legs regularly clipped, cannot but see that in all her features she not only shows Morgan blood, but indicates, almost certainly, the line or family through which the blood descended. The head, neck, back, hips, the short, broad, hairy legs, all show, if not Morgan blood, something exactly like it, and decidedly as unlike the thorough-bred blood claimed as is possible.

I have the impression that the mystery that so long hung over the blood and origin of "the little bay mare," was a Morgan mystery that did not suit her historians to clear up, until they could present it to the public in some shape that would credit some other blood than the Morgan.

In the history of Ethan Allen we find another case. If we search the records for the best double team time, we shall find that Lantern and running mate stood as the best, without question, previous to the time he met and was beaten by a Morgan horse; and only a day or two before that event, the editor of the *Spirit of the Times* (I think Porters), while evidently laboring under the delusion that the New York horse, Lantern, would certainly win on that occasion, stated that they expected that their next issue would contain the best double team time ever recorded. So long as the credit of this time was to redound to the glory of one of the New York families, it was a perfectly fair record, but when it was found that this record was to give glory to the Vermont Morgan blood, some excuse must be invented for not making it; and the next issue, instead of placing the time then made on the records, contained the announcement that they had discovered that it would not be fair to make it.

So, still later, the persistent efforts to belittle this kind of performance are, no doubt, due to the fact that no representative of the New York families has been able to wrest these laurels from a Vermont Morgan, or even approach his time, hitched with a running mate.

Now I claim that in a race, to go as you please, any horse entering has a right to harness as light as is possible, and have every advantage of that, as of his superior trotting motion and instinct, that is not disturbed by any attending circumstances into a break, and if he can go best in one kind of a hitch, and, in that hitch, make the best time ever made by any horse, he is entitled to the credit of the best recorded time ; and so long as the hitch that Dexter went in on the occasion that Ethan made his 2:15 (for years the fastest time made,) is of no more practical use, in every day service, than the one Ethan went in, there is just as much sense and justice in calling it the fastest time as it would be made in the other hitch, and I have no doubt it would have been made more prominent and oftener referred to as the fastest time, had Dexter, hitched in precisely the same way, been able to have beaten Ethan. I am convinced that that time has never been equalled by as even, clean, honest trotting stroke, throughout a full mile, as was made by Ethan Allen, on that occasion.

But we have spent quite time enough on this speed question, and perhaps more than its real merit, as affecting Vermont farmers and breeders, deserves. If the Morgans do not possess more valuable qualities for Vermonters, we should look for some other better race or breed, but as this has been made a test question by many, and as it is really a valuable trait, in so far as it indicates good travelling or roadster qualities in the race, and as there have been very persistent efforts, on the part of many, to belittle the speed qualities of the Morgans, I have given that subject a prominence that, under other circumstances, would have been unwarranted. From this speed the farmer derives very little pecuniary advantage, therefore, for him, it is of little importance, except as indicating the presence of travelling qualities of a high order, which we must have in the horses we raise in Vermont, both for our own use, and, also, to command prices in market that will prove remunerative to the raiser.

But I must be pardoned if I assert that Vermonters themselves deserve more censure than any one else, for the decline in popularity of the Morgans; first by selling their best instead of retaining them to breed from and improve their stock, and, second, in too readily accepting, as a fact, the claim of others, that the Morgans were inferior, and that we must buy some other blood to improve them, and especially must we bring in stallions of large size, as the Morgans were too small and deficient in bone, to get serviceable, good selling horses. As I have in this paper given my views in regard to breeding from small dams by large sires, it will not be necessary to give these views again, but I would remark that the Morgan horses, as a race, are not as tall as some others, but they seem to be finished up with stuff of more substantial quality, and not, like some others, composed of imperfect, gross material, any addition of which, to a first class Morgan horse, only increases his bulk, but detracts from his real value, as it only impedes his progress to carry so much more dead weight.

Some of the best horses ever raised in Vermont, as well as those that have brought the highest prices, have been sired by Morgan stallions, from such mares as were sired by Port Boy, Henry Bishop's Hambletonian, Harris Hambletonian, and others of their class; and if we wish to increase the size of our horses, we should do it by bringing in larger dams, not larger stallions; and with all respect for the motives of those who made the purchases for the late Vermont Horse Stock Company, I may be allowed to say that had they expended the money for a few fine mares, from the larger families, and purchased a first class stallion, like General Knox, that had been foolishly sold out of Vermont and had proved himself worthy of his origin by the excellence of his stock, I do not believe that company would have come to grief so soon, and the horses of Vermont would have been vastly more improved by the importation than they have been by those that were selected.

We often hear that the value of Morgan horses has become so much depreciated that there is no demand for them; that it is no longer desirable to raise them, as they will not bring remunerative prices. Many unthinking Vermonters take these statements as true, without any investigation to get at the facts, and only ask why it is so, and what shall we breed in the place of them? Now I propose to look this matter over and see what the facts are. Like an eminent divine, when asked why clergymen's sons were so much worse than other men's sons, I shall say, my first reason is that it is not so.

I have, for some years past, been convinced that we were being deceived as to the average value and prices obtained for the large mass of the horses raised from the large trotting families, by the extraordinary prices obtained for a very few fast ones, and have, from time to time, contended that Morgans would bring better average prices, and pay better for the farmers to raise. Last July, in the *Middlebury Register*, we published an account of a number of sales of Mambrino thorough-breds, Hambletonians, &c., and contrasted them with two where the blood was Morgan, or where the colts sold were sired by stallions descended through Morgan sires from Justin Morgan. The accounts of these sales were taken from two or three numbers of the New York *Spirit of the Times*, published immediately preceding the date of our article named. These sales were all extensively advertised, in previous numbers of the same paper, giving notice of their blood, breeding, &c. These sales were five in number, and were: first, one of Mambrinos, by Mr. Owen Fuller, of Terre Haute, Indiana; second, one by Messrs. Belmont & Lorrillard, of New York, two of the most celebrated breeders of thorough-breds; third, one by Mr. Edwin Thorn, of Duchess County, New York, one of the most celebrated breeders of Hambletonian stock, and whose advertisement stated that the stock offered was the get of Rysdyk's Hambletonian, Alexander's Abdallah, Manhattan, Volunteer, Sentinel, Thorndale, &c. From such sires we should expect the very best of Hambletonians, and those that would sell at the very highest figures for that kind of stock. The fourth sale was by L. L. Dorsey, near Louisville, Kentucky, of Golddust stock of Morgan blood; and the fifth sale was of yearlings, by Colonel H. S. Russell, of Milton, Massachusetts. These colts were sired by Fearnaught, who was a descendant of Justin Morgan through Bulrush and Morrill sires.

It would not be advisable or necessary to give the prices obtained for each animal, at these sales, but the average prices were as follows:

At Mr. Fuller's sale twenty-one Mambrinos brought an average of	$243 09
At Messrs. Belmont & Lorrillard's sale, thirteen thoroughbreds brought an average of	$144 61
At Mr. Thorn's sale, thirty-three Hambletonians brought an average of	$170 15
The average of the three, in the aggregate, is	$188 05

Against these, the sales of those with Morgan blood stand:

At Mr. Dorsey's sale, twenty-three of his Golddust stock, whose grand-sire was Vermont Morgan, the average was	$468 47

or more than twice as much as the average of the other sales, where the blood was claimed as so much more profitable than Morgan blood.

At Colonel Russell's sale, fourteen Fearnaught yearlings, whose grand-sire was Young Morrill, brought an average of	$580 71

or more than three times as much as the average of the three other sales.

The average of the two last sales is	$509 32

or a good deal more than twice as much as was realized by Mr. Fuller, who obtained much the highest average of the the first three sales.

If we analyze these sales more closely, we shall find the highest price obtained at each to be:

At Mr. Fuller's, of Mambrinos,	$750 00
At Messrs. Belmont & Lorrillard's, of thoroughbreds,	$280 00
At Mr. Thorn's, of Hambletonians,	$425 00
At Mr. Dorsey's, of Golddust Morgans,	$2,000 00
At Colonel Russell's, of Fearnaught Morgans,	$1,075 00

And the lowest at each sale to be:

At Mr. Fuller's,	$100 00
At Messrs. Belmont & Lorrillard's,	$80 00
At Mr. Thorn's,	$50 00
At Mr. Dorsey's,	$130 00
At Colonel Russell's,	$310 00

These sales and prices are actual facts, and I ask, in all seriousness, is there anything in them to convince you, farmers of Vermont, that other races and bloods are more profitable to raise for market than Morgans?

In view of all these facts presented, it would seem to be an easy matter for Vermont farmers to decide what course in breeding it was for their interest to pursue. But, having decided the question, some practical difficulties may arise to embarrass the farmers in pursuing the course it is so plainly for their interest to follow. It may be easy to decide to breed to Morgan stallions, but where are the stallions? It is true too many of the best ones have been sold and taken away, to improve the horses elsewhere; but some fine ones are yet left, and no true Vermonter should let a matter of a few miles, or even a few hundred miles, deter him from sending his mares to the best Morgan stallion within his reach, especially if his mares are of Morgan blood, or of some other good blood suitable to cross with the Morgan.

One thing it will be very necessary for Vermonters to do, if they wish to attain the highest excellence in breeding horses, and maintain the best reputation for their stock, and that is, to reserve their best to breed from, rather than to let what may often seem to be a high price tempt them to part with such, and breed from their poorest. Such a course is always a penny wise and pound foolish one for any breeder to pursue, who has a reputation to make, or who wishes to make the most money in the end.

The Ticonderoga farmer, who refused five hundred dollars for a three year old filly, and put her to breeding, found that five hundred a better investment than any other he had ever made. Few farmers derive as large an income from their entire farms, as did Mr. Baldwin from the mare in question.

Farmers of Vermont, save and cherish every drop of Morgan blood you have left. Breed to the best Morgan stallion you can find, save and breed from the best progeny only, and you have a certain prospect of profit in the future.

THE COMING HORSE.

BY Col. E. S. STOWELL, OF CORNWALL.

Ladies and Gentlemen:

By the courtesy of the Secretary of the State Board of Agriculture, Manufactures and Mining, and at the request of several of your prominent citizens, I present you my views upon the subject announced, viz.:

THE COMING HORSE FOR VERMONT.

Whether this request comes as a compliment to me, my system of breeding, or merely for the purpose of hearing this side of the question, I cannot say, and I don't know as it much matters, if what I do say commends itself to your better judgment.

Five years ago, come June, at a meeting of this Board at Brandon, I read a paper upon substantially the same subject. The experiences of these five years have in no way changed my views; peculiar for a Vermonter, though thought at that time, and subjected to much criticism by those who were interested in another system.

Time has vindicated the correctness of my words, and taught multitudes that farmers are unfitted to raise the small trotting horse; and that the business of raising trotting horses for speed alone is unprofitable, uncongenial, and demoralizing for farmers and farmers' sons, as I, myself, am.

It has been said that "criticism is the work of a literary failure," and if I pass this subject with the remark that the principle applies well to the criticism of breeders' experiences, and history-like repeat myself, by drawing somewhat upon facts, statements and deductions then presented, that have shown themselves sound by these five years' later tests, I trust I may be pardoned.

That Vermont *has* enjoyed an exceeding high renown for her horses, that the *Vermont Morgan* was, before the age of steam, when people travelled by their own conveyances, and rode day after day, up hill and down hill, weeks at a time, *or* when the United States mail coaches ran their daily lines over the hills and through the vales of New England, truly a valuable and, I may say, an almost indispensable assistant, no one will deny.

His courage, docility and indomitable pluck, his compactness of form, and short, quick step, admirably fitted him for, and gave him position as, a first class stage horse and roadster in his place; that he held long by the excellence of his achievements, and the roughness of the fields upon which he labored.

He was bred for a purpose, and admirably fulfilled it.

This is not an isolated case of breeding to meet the wants of a people, or the necessities of a locality.

In Virginia they have bred runners for years, because the state of their roads was such, and is, to-day, more or less, as to require saddle horses for rapid and easy locomotion.

The same may be said of Kentucky, Ohio, and others of the Western States, only that their comparatively level surfaces gave opportunity, in addition, to another type of saddle horse, to wit: the single footer or racker. With the opportunity, the demand; with the demand, man's intelligence; and hence the race of Kentucky pacers, known all over the West, and eagerly sought for for long horse-back journeys, as they are fine sized, good couraged, strong in the back and quarter, of great endurance, and can carry a man far in a day. and with comparative ease. It is from this blood, in part, Pocahontas being an illustrious type, whence come those remarkable trotters of the West: Smuggler, Grafton, Mambrino Patchen, Mambrino Bertie, Blackwood, and the Golddust stock.

As roads became good, and towns grew up, and business men desired wagon horses, by judicious crossing and training the pacer has emerged a trotter of most wonderful capacity.

Again, the long stage lines of New York State demanded teams to do their work in from ten to twelve miles an hour, and lo! those wonderful silver-gray Messenger teams, of the Sherwood lines.

A writer in *Wallace's Monthly*, speaking of Bush Messenger, says: "The glory of his life and memory is in the great number of incomparable stage horses with which he and his sons and grandsons supplied the great route from Albany to Buffalo."

There were, doubtless, other sons of Messenger that contributed, more or less, to these magnificent teams, but Bush

Messenger did more in this direction, perhaps, than all his other half brothers put together.

They were of fine size, mostly grays, and wonderful travelers. When steam superseded the stage coach, the stock was pushed into Ohio, and farther West; and one of the leading proprietors in that business in Ohio, Indiana, Illinois and Iowa, has often talked to the writer of the magnificent gray Messenger teams that were pushed out to them from Central New York. He spoke of it as an easy matter to select teams that would trot off with a coach load, a mile in four minutes, or twelve miles an hour, and for durability, as well as speed, there were none equal to them.

These illustrations could be multiplied indefinitely, and reference made to other families of the animal kingdom; as the ponies of the Shetland and the Western Isles; the donkey of the Alps; the pack mule of the Andes and Cordilleras; the ship of the desert, the camel of Sahara, etc., etc. But sufficient for the point, that the necessities of time and place give demand, and it is for man to learn what that demand is, and how to meet it to reap a large and abundant reward.

This, man's intelligence will ultimately do, though when great revulsions ensue, as the inroad of steam locomotives, it will be accompanied, and oftimes preceded, by mistakes and blunders, akin to disasters, even, from various causes: from great haste to meet the new demands; commencing in the wrong lines; aided by the representations of interested parties, they go astray; and it takes time to rectify breeding mistakes; the prejudice of the people; their predilections for certain families; their formed tastes, and disposition to follow in the ruts; all of which are causes of many losses and cruel disappointments.

Wedded to one idea, reasoning that because a certain line has been remunerative, that it will always be so, is not good policy, is not good judgment. It is that which has borne so long disastrously upon the Spanish nation, and brought them from their proud eminence in the days of the Spanish Armada, to the ignoble position of the present, subjects of the commiseration and pity, and offers of mediation by the nations of the earth, because unable to suppress a minor rebellion in her province of the Isle of Cuba; to say nothing of her Carlist insurrection.

To use a crotched tree for a plow, because the fathers did, is certainly a very poor commentary upon the intelligence and progressive improvement of any people; and for Vermonters to breed Morgans, after the circumstances that gave rise to them and rendered them in demand have passed away, even if they possessed the material to do it, which they do not, except in a limited sense, argues a condition almost or quite as reprehensible.

With the advent of steam power, old modes of travel passed away. The mail coach and the family carriage for journeys were as things that had been, but now out of commission, and condemned to act as tenders, as it were, to the puffing, hurrying railroad train, that,

"Rumbling over bridges,
Tumbling thro' the vale,"

caused the people to exclaim,

"Bless me! this is pleasant,
Riding on a rail."

The prevailing sentiment was haste. Railroad trains were not fast enough, though running faster, as a rule, than at the present time. With unlimited steam power, no horse to tire or reek with sweat, why should they not go fast, yea, *faster?* Their haste commenced at the door step, even, and the poor horse was hurried to the depot so fast that drawing the old fashioned carriage was so evidently to his distress that lighter vehicles were demanded, until they became little else than extenuated cobwebs. Faster horses, too; speed! speed! was the cry, until all else seemed swallowed up in the one quality. We were told that only little horses were fast, or could live with their speed. Once we believed this and bred them. It is true that many fast horses *are* small. Why should they *not* be? They were bred in that direction. It is also true that a large majority of the very fastest on the turf, for the past ten years, have been above medium size, and many even large, fifteen hand horses and over, fine, large carriage horses, as American Girl, Lucy, George M. Patchen, Old Put, Palmer, Fullerton, Gloster, Gazelle, Rolla, Golddust, Gilbert Knox, Rhode Island, Ericson, Blackwood, Smuggler, Pocahontas, Grafton, and a host of others of the stars, as you may say, of the trotting and pacing world.

The experience of railroads has been that "fast to run is fast to wear," and that great speed requires great substance; and of horsemen that, although the little horse, with light bone, fine style, and highly wrought nervous temperament might trot fast in a fifty pound sulky, on a good track, with nothing to excite him, for a mile, yet for long, fast drives, and in much exciting company, that business men take on the Boulevard and Harlem Lane, in New York, the Neck and out to Brighton, in Boston, and to other popular resorts in other cities, for their recreation, they want size, bone, courage, endurance, and, above all, *steadiness*, combined; and that same steadiness, or, in horse parlance, level-headedness, to judge from the answer of Dan Mace, whose ability as a trainer and race driver amounts to genius, to an amateur, who told him that he owned a young horse that could trot in 2:26 and repeat, and that he proposed to enter him in the great Northern Trotting Circuit, is quite as essential on the race track, if not more so, as any where else. "Is that *all* your horse can do?" says Dan. "What more is required than speed and endurance?" was the interrogatory. "Why," replies Mace, "you must not only train him in company, but when he can trot three heats close together low down in the twenties, and come down the home stretch under the whip, if necessary, at every stride, with a running horse at his side urging him up to the last fraction of his courage and speed; and all the grooms are strung out down the course and at the judges' stand, hallooing, beating tin pans and making all kinds of frightening noises, and yet the horse comes on steadily, without making a break or a mistake; *then*, and not till then, have you a reliable trotter that can win at Buffalo or Cleveland."

In Maine, in New Hampshire, in Massachusetts, in Rhode Island and Connecticut, the same general conclusion has been arrived at, that the breeding of trotting horses *distinctively* as a source of profit, is a failure; yet when speed is connected with other qualities, for general use and taste, such as color, size, style, etc., there is no doubt about its value and profitableness; and they have introduced large animals, from the most distinguished trotting and pacing families, as crosses for the smaller, more compact and more active ones, that size, bone, and an enlarged scope may be added to the many excellencies already possessed by them.

A wise people will present for use what the wants and needs of their customers demand and will pay the most *for*, all things being equal.

Who are the customers that we of Vermont are to breed horses for? Truckmen, with their fourteen, sixteen, or eighteen hundred pounds draft horses? No! they are contra to our genius, contra to our taste, and can be raised cheaper upon the broad western corn fields.

City rail car corporations? No, the western competition is too strong. We cannot afford horses at prices they are furnished them for by this same western colossal competitor. We must furnish speed with our horses, for speed brings money. For sporting men? Oh no! They are too few, and the rate of speed too low down in the twenties for us to even dream of successful competition with those having so much better conveniences than we, and so much more time to develop their colts before presenting them for the inspection of the public, and for the bids of purchasers.

Few of the average public know the amount of labor that is required to grow up a trotting colt and present him fitted for a race. The careful feeding, watering, shoeing, exercising, speeding, scraping, rubbing, cooling, grooming, they require day after day, week after week, for months and years, only those who do it fully understand. Farmers have something else to do; either that must be neglected or the colt, and neglect ruins him.

What then? We must breed a class of horses with a good natural turn of speed, especially a fast walk, of good style, fine carriage, good color, and of a size sufficient not to be *dwarfed* by a top wagon with the top *up*, and that can draw it and its driver, and perhaps a friend with him, from twelve to fourteen miles the hour, with occasional bursts of speed to get away from dust, or keep company with friends, or for the fun of going fast; and, by the way, I know of no exercise more exhilarating, of a mile in three minutes or better. If of uniform colors and make, so as to match easily, and are large enough for carriage horses, with plenty of style, a little less speed will do, and yet bring price enough to richly pay their cost.

In other words, the little horse will do for the race track if fast enough; if not, for *no other place*. The large horse, with the same conditions of speed, for the race track too; but withal the road, with or without great speed.

But few horses arrive at the point of great value for racing purposes. The great mass are required for the road.

The percentage of trotters of this value is exceedingly small in the best of families. Some writers say five per cent., others less, make trotters of especial value; at the best five trotters, ninety-five not trotters, in the hundred.

The breeding of the five, remunerative to the breeder if he is horseman enough to develop their speed *himself*; otherwise some lucky or dishonest dealer or trainer gets the profits of the fast colts, and the breeder the expense and chagrin of finding himself burdened with a lot of trash, if he breeds small stock, rather than a promising lot of salable horses, at mature age, suitable for the road, the carriage or the plow, that are certain to give him par value with a handsome margin, if he breeds size. A good sized, rangy, stylish, open gaited and enduring horse, of a good color, bay, for instance, from fifteen and one half to sixteen hands high, weighing from one thousand to eleven hundred and fifty pounds, will always bring a good price, and can just as well be bred, and bred fast, as smaller sizes and indifferent colors.

There has been a growing demand for horses of this character for years. It comes from the merchant princes and business men of our cities and large towns. Confined between four walls during business hours, and forced to breathe the foul smells of crowded streets, they thirst for a breath of the comparatively pure air of the suburbs. The suburbs are broad and wide, and far from business centers, and only horses of great ability are comforts to their owners or can long stand the work required of them.

What families in New York have the ability to stand this work and do it satisfactorily? Morgans? No, not speed enough. Black Hawks? No, not stamina enough. Ethan Allens? Not substance enough. Descendants of the old stage line Messengers, Hambletonian, and especially Clay crosses, are the ones that have proven themselves quite up to the line.

Riding up and down the drives of New York every day for a week or more, not long since, with a gentleman of large horse acquaintance, an associate of the Bonners, the owners of Fullerton, Lulu and Gazelle, and other noted men of the road of New York, quite often he would point out to me a horse with the remark, "that has been on the road six years, that eight years, that ten," and so on, "and can take a forty clip or better any day in the week, and is perfectly sound in wind and limb," and would reply almost invariably to the question what blood? "Oh! that's a Clay." That rare coterie of distinguished horse critics from New York at our last State Fair at Rutland, Messrs. Charles Backman, David Bonner, Dean Sage, Shepherd Knapp, Colonel Phife, J. B. Alley and L. H. Packer, were unanimous in their declarations that unquestionably the best and most popular cross in breeding, in and around New York to-day, was the Hambletonian and Clay; the forward, quick stroke of the Clay balancing and quickening the tendency to too long strides and dwelling of the Hambletonian.

Herk Comstock says of Mr. Backman: "The ascendency of his own mind in the formation of his plans is well defined in the fact that he early adopted strains of blood in great disfavor at that time, but which have since proved signally successful. Noticeably among these we find the Clay family, from which, under opposition, he selected several brood mares, got by his chosen favorite sire of the line, Sayre's Henry Clay. Among them we find Hattie Wood (dam of Gazelle), Mary Grinbey (dam of Loadstone), and Green Mountain Maid (dam of Storm, Electioneer, Prospero, Dame Trot and Miranda)." Aside from Mr. Backman's success with this once condemned but now fashionable strain, we have notable instances of its value in Bodine, St. Julien, George M. Patchen, American Girl, Lucy, Orient and many others. Hiram Woodruff says of one of them:

"When everything is considered, I am of the opinion that George M. Patchen was the best horse that Flora Temple ever contended with and that, therefore, their names must go down linked together as those of the best mare and the best stallion that have yet appeared."

The struggle to keep up the reputation of Vermont horses has been long and arduous. Men there have been who, catching an inspiration as it were, or a glimpse of the truth, have imported foreign blood such as Harris' Hambletonian (by Messenger), Megg's Abdallah (by Abdallah, by Messenger), Cock of the Rock (by Duroc), Berney Henry, and the like, to increase the size, lengthen the stride and raise the standard of Vermont horses; but people have patronized them with extreme caution, and only found out their value when they had passed away or, perhaps, not at all; when their stock became brood mares from which Morgan stallions made their reputations, the product of which was Morgan, Black Hawk or what not, as the case might be, always accredited for whatever merit it might possess to the stallion that sired it, from whence it took its name.

In the mares thus obtained there were elements of great success, but the traditional love for the Morgan was held so tenaciously in our hearts that we ignored their influence and fell back upon the Morgan, as exemplified in the Black Hawk to the second and third generations, greatly to our detriment.

Black Hawk found many good mares in Vermont, descendants of these foreign horses, and Photo, Addison, Pathfinder, Rockwood and his son, General Knox, among stallions; Belle of Saratoga, Lady Sherman, Lady Litchfield and Boston Queen, among mares, and many others were their produce, and their product was excellent; for the beauty, symmetry, and general usefulness of colts bred from such mares were a wonder to all. But as these old mares passed away, and the stock interbred with other Black Hawk stock *without* common maternal strains, the Black Hawk predominated, standing two to one, and the results were to decrease size and bone, and utterly destroy their reputation, thus fastening upon us a small sized, chubby, rugged little horse, to be sure, but degenerate and without the power of recuperation, unless by slow and tedious process of careful and discriminating selections of proper animals, having the stronger blood in common, for long series of years, too long, I think, for Yankee patience to endure.

With sheep in flocks of hundreds, and mares in a harem of fifty or more, like Robert Bonner's or Charles Backman's, ten years' experience in breeding (I might almost say one,) is more than a life time with the number of mares that we individually are able to keep. My experience in sheep has taught me that *like does not produce like* exactly, but intensifies characteristics and especially peculiarities. Now then, breeding small horses with small horses, or those having common strains of blood of small horses, that blood predominates, and the product is *smaller* than either of the parents, and, if pursued, will go on generation after generation from little to less, growing finer and smaller, like the Arab, the Mexican Mustang or Indian Pony.

If breeders would provide themselves with such mares as were common in the days of Black Hawk in Vermont, or such as those old Winthrop Messenger mares that General Knox found in Maine, or those Abdallah and Trustee, Messenger and Mambrino mares that Young Morrill found at Boston, or the Mambrino, Abdallah and pacing mares that Golddust found in Kentucky, small, fast stallions would produce equally good and even better stock than was and is produced then and there. For I have no doubt but we have stallions equal to any the world has ever produced of that class.

But will they ? or can they ? Does not small stock prevail among us ? and is not the tendency of nearly all to breed from what they have, especially if rendered unsalable by hard work, accidents or strains ?

Every one knows that his old mare, that has been so long in the family and done such faithful service, is a little better than his neighbor's. Of course, this is the tendency, and this is the practice, to a great extent, and it is not so very destructive, after all, as we have sometimes thought, if care is used not to breed mares having hereditary ailments, *provided* a judicious selection of stallions is made; for it is no doubt true that the close built, round muscled, little Black Hawk or Morgan horses have very many qualities that we cannot afford to lose, and we need not lose them.

In the last few years there has been a growing opinion in the minds of most intelligent horse breeders of our land, that the old theory of large female, small male, though good, must give place in a measure to the absolute facts as they are developed from day to day and year to year: that the fastest and best horses, those showing the best staying and enduring qualities, are being produced by breeding the small, fine boned, enduring, cheerful, courageous female to the coarser boned, larger sized, heavy trotting horse, the produce taking their bottom, their nerve and their indomitable courage from the dam, and their square trotting, long, low, sweeping stride from the sire.

It was such mares that brought the Hambletonians, the Abdallahs and the Henrys of Vermont in olden time, and we stand higher to-day, a long way, in the estimation of judges, as a horse breeding State, for those and their descendants than for any other. Not long since, Mr. W. W. Comee, of Boston, a man that stands high as a dealer in fine horses, and as a critic of large opportunity and excellent judgment, while looking over my stock from Mambrino Patchen and Landlord, remarked that they reminded him of the Henrys that he used to see in this and neighboring counties years ago, and that he was exceedingly glad to see such horses here, as he knew of no place where they would be the means of so much improvement, and he would rejoice again to see the day he could come here and get up the magnificent bay teams he used to do.

Such has been the result in Kentucky, from crossing that coarse old horse, Mambrino Chief, with their fine boned thorough-breds, and Lady Thorn, Mambrino Pilot, Boy Chief, Bold Chief, Ericson, Mambrino Bertie and many others, well known to horsemen, are the products.

Such has been the result in a marked degree, in Orange County, New York, and vicinity, crossing Rysdyk's Hambletonian, that double son of Old Messenger, through Abdallah and Vermont Hambletonian, with American Star mares, the renowned descendants of the old four miler, Henry. Hiram Woodruff says: The Messenger cross gives the Stars size, strength and bone, and counteracts their hereditary tendency to contraction of the feet." We may say that any cross that would produce a Dexter, George Wilkes, Major Winfield, Aberdeen, Startle, Socrates, Happy Medium and so on to almost unlimited extent, was a good one, but when we consider that these crosses not only give as large a per cent. of fast trotters and *larger* than any other, but also to the everyday breeder a sure thing in size, in style and good, slashing, open gait, so that led out at four years old, to the halter, by any farmer's lad that can run fast enough, they would easily bring highly remunerative prices to the breeder, not only for the five in a hundred but the ninety-five withal. We have reached the point long aimed at, a class of horses in which each and every one will be worth all he costs; a class of fast horses, suitable for the track, the road in light or heavy hitch, for the wagon or the plow.

This result is within easy reach of you all.

The Morgan Black Hawk, Ethan Allen and Lambert mares you have, and there are none better of their class. The Hambletonian and Clay stallions have been brought into the State within the past few years, and most excellent ones they are and of easy access.

Let me urge you to take up the abundant material already made to your hand, profiting by your own experience and that of the great number of excellent examples of successful breeding in the land; breed intelligently; study your subject, and labor to add to the weak points and take off from the too prominent ones. Remember that like intensifies characteristics, and breed the short stepping, close Morgan or Black Hawk to the looser made and longer striding Hambletonian; the longer gaited, lighter boned, nervous Ethan Allen or Lambert to the heavier boned, forward action of the steadier Clay or Mambrino stallion, and soon reach the acme of your ambition, *the well balanced, perfect gentleman's driving horse*, combining the beauty and agility of a Lambert with the toughness and docility of a Morgan, the size and stride of a Hambletonian, the action and substance of a Clay, and as much speed as any class of horses in the world.

Such is the *coming horse* of Vermont.

It rests with you, gentlemen, and your compeers, whether in the near or more remote future; whether you take up the elements thus offered, or those that come after you; the event is certain, and whoever is its instrument will reap a sure and abundant reward.

THE MORGAN HORSE.

BY J. F. HEMENWAY, OF CHELSEA.

It seems very appropriate that at a meeting of the farmers of Orange County, this subject should receive its share of attention, since it is the home of the founder of the best family of horses in America, which appeared in Randolph, A. D. 1795, and was owned by a poor singing teacher.

As this horse was but fourteen hands high he was passed by in contempt, and had lived out nearly the days allotted to the life of a horse before his value was known; and when we think of the odds against him and his final triumph, we can come to no other conclusion than that he was the most remarkable horse of which we have any history.

In the first place we wish to see what class of horses are best adapted to Vermont, to the purposes for which horses are used in the State (which now in these days of labor saving machinery is a very important item), and for the surplus to receive the most money according to the cost of production.

It is a settled fact that we cannot raise large horses for the team and carryall, they can be so much more cheaply raised on the rich prairies of the West, and by cheap transportation, flood our Eastern markets; but stylish, enduring roadsters, trotters and gentlemen's drivers, standing from fifteen to fifteen and one-half hands high, and weighing from nine hundred to ten hundred and fifty pounds, have not been so successfully produced elsewhere, as in the invigorating climate and upon the sweet feed of the green hills of Northern New England. These are the horses for which there is the greatest demand, and for which the highest prices are paid, and this is the size that nature has associated with the most perfect physical organization, that is, the medium size, or, in the words of Linsley:

"We believe it is a fixed and unyielding law of animal life, that in medium size we shall find the greatest activity, the best constitutions, the greatest power of endurance and the most courage and vital energy.

"In the human race how strikingly is this law illustrated! It is the men of close, compact figures and medium height that possess the best constitutions and are most active and enduring. The athletes of the amphitheatre are men of medium size, with close, compact, muscular figures. Mark the men who live to the age of ninety or one hundred years. They too are of medium stature, with swelling chests and close knit, vigorous forms.

"Large cattle are slow in their movements, and the heavy Durham or Herefordshire cannot compete with the low, compact and hardy Devon in action, speed and endurance. The largest varieties of the dog are quickly conquered by the small, but active and vigorous terrier. And the tall, heavy Chinese fowls are speedily overpowered by the smaller, but nimble and high tempered gamebird.

"The horse is not an exception to this general law; and the breeder who fancies he can produce a class of tall, heavy horses, possessed of the activity, the endurance and nervous energy that belong to animals of a smaller size, will find upon trial that he has underrated the difficulties of the undertaking."

Having decided what style of horses can be reared to the best advantage in our State, our next enquiry is, from what family of horses can this class of stock be most successfully produced? I unhesitatingly reply, the Morgan, and proceed to give my reasons:

First, the Morgan is the strongest blooded family of horses in the country, and can, therefore, be bred more uniformly than any other breed; secondly, they possess the grandest combination of beauty, tractability, speed and endurance; and lastly, his thorough acclimation and adaptation to our soil and uneven country, I having no doubt he owes as much to our bracing climate and the nutritious grasses of our rough pastures as to the blood of that world renowned old horse—Justin Morgan, a description of which I take from a work entitled "The Morgan Horse":

"The original, or Justin Morgan, was about fourteen hands high, and weighed about nine hundred and fifty pounds. His color was dark bay, with black legs, mane and tail. He had no white hairs on him. His mane and tail were coarse and heavy, but not so massive as have been sometimes described. The hair of both was straight and not inclined to curl. His head was good, not extremely small, but lean and bony; the face straight; forehead broad; ears small and very fine, but set rather wide apart. His eyes were medium size, very dark and prominent, with a spirited but pleasant expression, and showed no white round the edge of the lid. His nostrils were very large, the muzzle small and the lips close and firm. His back and legs were perhaps his most noticeable points. The former was very short; the shoulder blades and hip bones being very long and oblique and the loins exceedingly broad and muscular. His body was rather long, round and deep, close ribbed up; chest deep and wide, with the breast bone projecting a good deal in front. His legs were short, close jointed, thin but very wide, hard and free from meat, with muscles that were remarkably large for a horse of his size, and his superabundance of muscle exhibited itself at every step. His hair was short, and at almost all seasons soft and glossy. He had a little long hair about the fetlocks and for two or three inches above the fetlock on the back side of the legs; the rest of the limbs was entirely free from it. His feet were small but well shaped, and he was in every respect perfectly sound and free from any sort of blemish. He was a very fast walker. In trotting his gait was low and smooth and his step short and nervous; he was not what in those days would be called fast, and we think it doubtful whether he could trot a mile much, if any, within four minutes, though it is claimed by many that he could trot it in three. Although he raised his feet but little, he never stumbled. His proud, bold and fearless style of movement, and vigorous, untiring action, have perhaps never been surpassed. When a rider was on him, he was obedient to the slightest motion of the rein, would walk backwards rapidly under a gentle pressure of the bit, and moved sideways almost as willingly as he moved forward; in short, was perfectly trained to all the paces and evolutions of a parade horse, and when ridden at military reviews (as was frequently the case,) his bold, imposing style, and spirited, nervous action, attracted universal attention and admiration. He was perfectly gentle and kind to handle and loved to be groomed and caressed, but he disliked to have children about him, and had an inveterate hatred for dogs, if loose always chasing them out of sight the instant he saw them."

I have given you thus a minute description of this famous horse, because I consider him, in most respects, the perfect type of a Vermont horse, and the fountain from which all the famous stock horses of New England drew their blood. It is a fact that New England has never had any stock horses able to perpetuate their name and fame save those of Morgan blood.

The following was taken from "Murray's Perfect Horse." I have two reasons for presenting it to you; the first is, to show you what eminent horsemen outside of Vermont say of the Morgan Horse; and the second is, it is the most truthful and logical statement of the excellencies of the Morgan stock for breeding purposes that I have seen. He says:

"I claim for the Morgan horse a few things which make him the most desirable horse on which to base experiments in crossing that any man ever had. The first of these peculiarities is this—*the power of transmitting his excellencies to his offspring.*

"The second excellence for which the Morgan is noted is beauty. Twenty years ago speed was everything. If a horse could *go* that was enough. We have lived beyond that period. Beauty is demanded now in the markets, and paid for handsomely, and the questions with every breeder therefore necessarily are, What is the cross by which I can add beauty to speed? Where can I get the fine, rich coat, the spirited face, the quick ear, the arched tail, the small, black hoofs, the flat, wiry legs, that shall cause men to contend for the possession of my colts? That is what Mr. Taggart, Colonel Russell, Mr. Dorsey, Mr. Nevins, and Colonel Sprague wished to know; and that is why they all went to the Morgan family for stallions, to head their respective stables. I ask any man to select in all the country six other stallions of such striking beauty as Taggart's Abdallah, Fearnaught, Young Fearnaught, Ethan Allen, Rolla Golddust and Lambert, all direct descendants from Justin Morgan, and strongly marked with the Morgan characteristics. For beauty, give me in breeding a Morgan horse for a sire and a well bred mare for a dam. With such a cross, I know what I shall get, so far as beauty goes at any rate; and beauty is growing to be worth more and more in greenbacks every year.

"The third characteristic of a Morgan horse is their *docility*. 'You can teach a Morgan colt anything,' is a proverb among the people; and the proverbs of a people always blossom out of facts. And it is a fact that the Morgans are teachable. They are amiable as a race and of a very affectionate disposition. They love to be petted and caressed. They will do as much for a word as for a blow. They are never tricky. That they are high strung and frisky we admit; but their playfulness is always good natured, never vicious. Even in their wildest antics they are never destructive, but are careful and yield readily to rebuke. If speedy they can be trained without difficulty, if you will let the whip alone, and will do all that in them lies at the word of the driver. The Morgan horse is beautiful; he is also docile; and these characteristics he *transmits*,—three steps, at least, that lead to the equine throne.

"The fourth characteristic peculiar to the Morgan horse is *endurance.* A hardier race of horses was never bred. In power to do hard work *and keep on doing it*, month in and month out, the Morgans stand at the head of the column. In lung power they are simply perfect; in feet and limbs faultless; in muscular formation marvelous; and in connection with this was a nervous or *vital* force that seemed to be equal to every effort, and appalled at no emergency. Years did not appear to lessen their power or dampen their ardor. At twenty they were as young as members of other families at ten; and at thirty, their eyes had not lost their fire or their action its boldness. Now this *iron like quality* is what breeders must put into their colts. We can get speed easy enough but we must have speed and the power to keep it up, mile after mile, and hour after hour. *Endurance* is what we must have in our horses; and this is precisely what the Morgan blood gives. It is pre-eminently the heirloom of the family, and is handed down from sire to son in undiminished integrity.

"The last characteristic of the Morgan family that I shall mention is *speed.* It is said by some that the Morgan family has no speed. If this were true, still there would be such great excellencies of form, temperament, color and style, that it would remain a most valuable family with which to cross in breeding. But it is not true; for the fact is, all things being candidly considered, I believe every one will admit that they have produced more trotters than any other family in the world. To his beauty, docility and endurance, his friends may add the word speed, and bide, with cheerfulness, investigation and comparison. The farther I push my inquiries in this direction, the more I am astonished at the evidence."

The number of fast horses lineally descended in the male line from Justin Morgan surprises me. There are forty-nine lineal descendants of Justin Morgan that have trotted as follows:

Forty-nine better than	2:36
Forty better than	2:30
Fourteen better than	2:26*

Now I wish to inquire what other horse has New England ever had with such a list of descendants?

Where is the "Bush Messenger" family to which New England is so much indebted? Will some one please mention the Hambletonian trotters? If I write earnestly and strongly, I do it, be it remembered, in defence of a family of horses suffering from a most unjust impeachment, and in vindication of a great truth that it is for the interest of every New England breeder to know, viz.: that the family of horses which has been distinguished by and embodied the four great essentials of the perfect horse—beauty, docility, endurance and speed, is the Morgan.

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* This was in 1872. In 1874 the records show that the Morgans had more horses that came below the charmed circle of 2:30 than any other family.

But after all this, and it is admitted that they are the best horses for all work in the country, that they are the most capable of performing the various labors of a horse in New England, the fashion is for a tall, rangy horse, and the Morgan is not as tall as some other families.

Ah, here is the point; the shoddy aristocracy of New York have set the fashion. They well knew their favorites could not compare with the Morgan in the grand combination that goes to make up the horse of all work; but their horses were taller, therefore by setting the fashion for tall horses the Morgans would be left out in the cold.

In reply to this, I protest against New York dictating the fashion of our horses, and I protest against our being such consummate fools as to try to follow.

This fashion has been the great stumbling block in the way of our breeders, leading them to neglect the useful points in their anxiety to rear a sixteen hand horse, to suit the fashion of the hour.

How strikingly is this illustrated in the history of the horse business in this State. When we were breeding the purer Morgan of twenty years ago Vermont stood at the head of the list in the production of fine horses. But the attempt to rear a tall, rangy horse to hit this fashion has had a damaging effect upon our horses. They were no more adapted to our surroundings than the rank growing, late maturing corn of the prairies is for the hills of Vermont.

It is a self evident fact that the perfect size for a horse is the size nature has lavished the most gifts upon that pleases the eye the most, and is best able to perform the labors that devolve upon him.

We have shown this to be the medium size, and the Morgan the best family to breed him from. I look forward to a good time coming when he shall be measured by his accomplishments, and not by a fictitious, arbitrary standard of fashion.

Then will the Morgan be appreciated, and Vermont take the place that nature gives her as the producer of the finest horses of America.

SHEEP AND SHEEP HUSBANDRY.

BY A. E. PERKINS, OF POMFRET.

MR. PRESIDENT, LADIES AND GENTLEMEN :

My subject on this occasion is Sheep and Sheep Husbandry. I deeply feel my inability to do justice to my subject on this occasion, for the sheep is one of the most useful and meritorious of our domestic animals, though humble it may be. I have time to give but a mere outline of the merits of some of the families of sheep, and some of the essential and too much neglected points in good sheep husbandry.

According to the most reliable authority I can obtain, the present number of sheep in the United States is about 37,000,000, yielding an annual clip of wool of 150,000,000 pounds. The number of sheep slaughtered for mutton yearly is about 7,000,000.

The capital invested in sheep and sheep husbandry in the United States is over $250,000,000. The annual product of these sheep is about $90,000,000.

This is not a large exhibit for a country of the size and population of the United States. Brazil has in number 70,000,000 sheep. The total number of sheep in the British Islands is 34,500,000. England is the greatest sheep producing country in the world in proportion to its cultivated land. The Spanish proverb, which is "The hoof of the sheep is gold," is true with the British, for they receive annually for their sheep the sum of $150,000,000.

The practical questions for us of New England and the Northern States to consider are: Can we afford to raise sheep, and if so, what kind or kinds, and what should be their essential qualities, and how can we best keep them?

The first question may be truthfully answered that we cannot afford to raise sheep for the annual clip of four or five pounds of wool per head and lose sheep and lambs enough yearly—the sole cause of which is starvation and neglect—to offset for the number of lambs we raise. Such sheep husbandry as this does not pay, and I think those persons engaged in it do not believe in sheep.

The first question can also be truthfully answered that it does pay to keep sheep which shear seven or eight pounds of wool per head, and by reason of the good care and attention they receive, they raise annually most of their lambs, which sell readily, when arrived at maturity, at from four to ten dollars per head. Those persons engaged in such sheep husbandry as this, believe in sheep, and care but little about the talk we sometimes hear about the cheap sheep husbandry of California and other like places superseding our raising sheep.

The foregoing answers are intended to apply to the keeping of grade sheep.

It also pays to keep the various kinds of thorough-bred sheep which shear annually a valuable fleece and which raise lambs which, when they arrive at maturity, sell at from twenty to thirty dollars per head, and occasionally extra ones for one hundred dollars apiece.

This is not a fancy sketch but a correct statement of facts, as to the present worth and value of the best flocks of Merino and Southdown sheep.

I will briefly call your attention to the merits of two families of thorough-bred sheep, namely, the Merino and the Southdown. If antiquity is a merit, the Merino sheep have that merit, for they are a relic of the civilization of ancient Greece and Rome. The ancient Romans clothed themselves with garments manufactured from wool. The prices paid for fine wool sheep in those days were sometimes as high as a talent apiece, which sum, in the Greek, is equal to about twelve hundred dollars of our money. This sum, you will understand, was paid for sheep per head in the good old hard money times—there was no discount upon paper then.

The merits of the Merino sheep of to-day are that they produce a large proportion of the clothing wool of the world. They also produce the greatest amount of wool in proportion to their size and cost of keeping of any family of sheep.

A large proportion of the mutton consumed in the United States is from sheep that have more or less Merino blood in them, and we do not hear any complaint as to its quality when well fatted.

The greatest value of the Merino sheep is in the improvement they make when bred to other sheep in the increased quantity and in the quality of wool without increasing the expense of keeping them. In this respect they have added millions to the wealth of this country. The wants of the times demand a sheep that shall combine the best qualities of wool and mutton; and in this respect I have not any fears but that the improved Merino will be one of the successful competitors.

The production of any superior commodity, or the production of any superior kind of stock, cannot possibly be overdone; as Webster said, there is always plenty of room in the upper story.

The Southdown sheep, as their name indicates, originated from the Downs in England. They have been bred with a view to develop the best mutton qualities of a sheep. They are large in those parts of the body where their flesh is the most valuable for mutton, and small in those parts where it is of the least value, as in their necks, &c. They have been bred with a view to dispense with everything practicable that did not contribute to this one idea, viz., superior mutton. Their wool has been a matter of secondary importance. It is said of them that a carcass of Southdown mutton has twenty per cent. more of edible meat than the other varieties of mutton sheep. They are a hardy, robust, docile sheep, which are easy to keep and fatten. They are prolific breeders. A flock of ewes will sometimes raise one hundred and thirty per cent. of their number of lambs. The average weight of improved Southdown she p, when arrived at maturity, is one hundred and fifty pounds. They will shear a fleece annually of seven pounds of unwashed wool per head. Their wool forms an intermediate link between the coarse wool and Merino sheep. When bred with the Merino the result is a sheep that combines, to some extent, the good qualities of both, and are a hardy, robust sheep, and will withstand neglect better than most kinds, and are called the best negligent farmer's sheep.

There are some essential qualities in the Merino sheep that they should always have. The first is a good constitution, which means a hardy, healthy, robust, strong sheep, to which should be added good size and shape, with good bone. We may have a sheep that is straight Atwood, straight Hammond, and a pedigree beyond question, and it may have all the fancy points, and if it lacks a good constitution we have a poor sheep. This is a fact that will apply in the main to all families of sheep.

After constitution, the next essential quality is the fleece, which should be of good quantity and quality, of a long and strong staple of wool, which should, so far as possible, be evenly distributed over the body.

The improvement most needed in the Southdown sheep is in increasing the quantity and improving the quality of their wool. With this improvement they will make one of the best varieties of sheep for the wants of the times.

The practice of buying wool at an average price per pound, without regard to its quality and condition, is paying a premium for and encouraging the growth of poor and dirty wool, for grease and filth cost but a trifle per pound compared with choice and clean wool. Wool growers who raise wool above the average, as to quality and condition can do better than to sell it at an average price by sending it to a reliable commission merchant, where it will be sorted and sold according to its merits. This is a safe and satisfactory way to sell good wool. It is not to be expected that wool buyers will advise farmers thus to dispose of their wool, for it deprives them on all the wool thus sold of their commission for buying, besides some twelve cents per pound extra, in addition to that, for all the delaine wool they sort out.

DELAINE WOOL.—Good delaine wool should be at least three inches in length, and be a round, strong staple of wool. I have several samples here for your inspection. This wool is now worth in market from fifty to fifty-seven cents per pound.

GOOD SHEEP HUSBANDRY.—The possession and keeping of any of the choice and valuable varieties of sheep will be of little avail, unless it is accompanied with good sheep husbandry.

It is essential to good sheep husbandry for the owner or shepherd to believe that only by good care and attention to the sheep he can succeed well in the business or make it pay. The shepherd should be a person who is fond of sheep, and it should be his delight to care for them. He should believe that the time spent in caring for and the food given them is neither lost nor wasted.

Another essential point in good sheep husbandry is to keep the sheep in a thriving, healthy condition in all seasons of the year. If our sheep are losing flesh and running down we can, during such time, get but little pay for keeping them. At such times the wool grows but little and it is weak and unsound. To expect to raise a good quantity of good wool upon a sheep that is poor in flesh is like trying to raise a good crop of grain upon poor soil.

Good sheep husbandry costs less than poor and pays three fold more. Good sheep husbandry consists in a great measure in doing the right work at the right time. Thus, if we shear sheep, do it in season; do not let them wear their fleece a month after it has become burdensome to them. June is one of the best months in the year for sheep to thrive if they are shorn. It costs less to house a flock of sheep that are just shorn before a storm than it does to cart them to the barn when they are benumbed and chilled. It costs less to mend the fence before the sheep get in the habit of being unruly, as we call it. It costs less to cut and cure the hay in season and when the sun shines than it does to do it out of season and in rainy weather. If from any cause the hay is poor, it costs less to feed some grain in season than it does to let them lose flesh and get poor, and then spend our time in doctoring them. I think there is a proverb, which is, that good food is cheaper than doctors. Without pursuing this subject farther, I repeat that good sheep husbandry costs less than poor and pays three fold better.

CARE OF SHEEP DURING THE SUMMER MONTHS.—A flock of sheep require but little care during the summer months except that they have a plenty of good feed and salt, and are seen to that none of them are sick or diseased. The principal work to be done in this season is to raise a suitable quantity of roots, &c., and cut in the proper season and well cure and store the necessary supply of hay and grain. Roots, apples and pumpkins are necessary to some extent for the sheep in the winter, not only on account of the nourishment which they contain, but to supply the lack of green feed and to keep the sheep in a healthy condition.

The cutting of the hay in proper season and well curing and storing the same, is one of the great essential points in good sheep husbandry. If from any cause we fail to do this, our sheep the next spring are usually poor and weak, and we have bad luck in raising lambs, the sole cause of which is, that the sheep, during the winter, have been eating poor hay, and vainly endeavoring to obtain from the same their necessary amount of nourishment which the hay did not contain. Coarse and rank timothy makes fair sheep hay if it is cut a few days before it begins to blossom and is well cured. Nearly all kinds of low land and swamp hay are good sheep hay if cut in season and well cured. Sheep prefer a variety of good hay instead of being confined to one kind only.

Lambs should be weaned when they are four months old and turned into good feed. If they are fed daily, in addition to good grass and hay, one pint of oats and shorts apiece until they are turned out to grass the next spring, they will have a good start towards making a sheep with a good constitution. I believe it to be a fact that if we would raise a sheep with a good constitution, we must supply them liberally, during their growth, with that kind of food that will furnish them with the necessary amount of bone, muscle and strength.

Sheep, and lambs in particular, should be housed during cold storms in the fall, and be fed with hay, which they should learn to eat before they are entirely deprived of grass. All kinds of sheep, and breeding ewes in particular, should come to the barn in good condition in the fall. This is necessary in order that they may be able to well develop their lambs. All kinds of sheep should be allowed to run out upon the ground daily in the late fall and early winter, so long as the ground is bare. This is necessary for their exercise, which promotes health, strength and vigor. A reasonable amount of exercise is necessary for sheep during the entire winter and spring. Sulphur and ashes should be fed to sheep with their salt during the winter. Sulphur is healthy for the sheep and is offensive to vermin. The ashes are also healthy and are essential for breeding ewes.

I presume that some of you have seen lambs that when they were first dropped were strong; their dams gave a good quantity of milk, yet in a few days the lambs would begin to droop and finally die. If you were to open the stomach of such lambs, in some cases you would find it packed and distended with a hard curd which was the cause of their death. The remedy for this is to feed the breeding ewes with some kind of a mild alkali like ashes, for some time previous to their lambs being dropped.

Sheep should be turned out upon the ground daily as soon as there is a spot bare that is large enough for them to stand upon, for the air in their pens and stables is generally impure, and no amount of good feed will supply the lack of good air and exercise.

There are various diseases which sheep and lambs sometimes have, and troubles to encounter in breeding sheep. There are causes for all of these. It should be one of the studies of the sheep breeder to learn what those causes are and avoid them. When we do that we shall make good luck in sheep husbandry.

Brother sheep breeders of Vermont, we have had of late a dark night of depression in our business. During this time a Victor Wright, Edwin Hammond, Judge Colburn, and Nathan Cushing have passed beyond this life. They were some of the pioneers and landmarks to us in sheep breeding. We remember their many acts of kindness with gratitude. Their loss we deeply deplore. Their flocks of sheep have to some extent been scattered; some of them have been sold and gone to distant lands, carrying with them a good name into other lands. But we will not be discouraged, for the night, although long and dark, is fading away and the dawn is appearing. Already unmistakable signs of returning prosperity greet us on every hand. Let us rally to our work, which is to show to the world by our acts and deeds that the fine wool sheep breeding of Vermont is neither waxing cold nor disappearing, but that its course is onward in the march of improvement.

SHEEP HUSBANDRY.

BY JOHN H. MEAD, OF WEST RUTLAND.

In speaking on this subject, I am fully satisfied that it is one the importance of which is second to none in our glorious old State of Vermont. For I believe that upon her mountain sides shall ever, as long as time lasts with man, be found the best and most beautiful sheep in the world; and in the future, as in the past, men from every quarter of the globe will seek here for the best sheep in the world. For with a common interest as a breeder myself, to encourage breeders of sheep to look after their interest more closely, and to breed better, to encourage men to keep better sheep, to encourage young men to embark in the interest of sheep husbandry, and to encourage poor men to look after so small an interest as one sheep even, are given my feeble efforts in this paper.

In the spirit of the injunction "Do unto others as you would that they should do unto you," I ask your kind attention to a few simple facts, stated in the most simple manner.

The familiar animal, dignified by the naturalist by the name *avis ories*, or our domestic sheep, will be the subject of these remarks. There is considerable resemblance between the ovis, or sheep, and the capra, or goat. The distinctions between them are briefly these: the horns of the sheep have a spiral direction from the sides of the head out, while those of the goat have an upward and backward direction. The sheep, except in one wild variety, has no beard; the goat is bearded. In his highest state of improvement the goat is made to produce wool of a fineness unequalled by the sheep, as in the Cashmere breed. He is mainly and always externally covered with hair; while the hair on the sheep may, by domestication, be reduced to a few kemps, or coarse hairs, or gotten rid of altogether.

Agriculturists have applied different names to sheep, according to the age and sex. The age of the sheep is generally readily determined by their teeth. When they are about one year and a half old they shed their two centre teeth of the incisors, and two wide ones grow out and take their place. The next year the next two are shed, and when the sheep is three years old the four central teeth are fully grown. At four years they have six teeth, and at five years the teeth are perfectly developed. This is one year before the horse or ox can be said to be full-mouthed. This rule for the age of sheep will hardly ever fail in ewes; but will sometimes in the case of rams. If not too old their age may be determined by the growth of their horns each year. The difference caused in the shedding of their teeth may be by the manner in which the sheep are cared for. If well fed and kept in a thriving condition they will shed them faster, and vice-versa. Some sheep with the full mouth will hold their teeth much longer than others.

The natural age of sheep is about ten years, to which time they will thrive and breed well.

Youatt, in his work on sheep, states that there are instances of their breeding at the age of fifteen years; but I think that I can safely say, that our sheep have been so much improved, that the average may be placed from twelve to fifteen years, and I have known of instances of their breeding at twenty-one years of age and over. I had one in my flock that bred at twenty-one years of age. She had a broad chest, fore legs wide apart, heavy fold about the neck, round shoulders and hips, deep bodied, strong in the quarters, folds about the tail, strong limbs This form of sheep, possessing strong constitutions, is what many of our best breeders are breeding for at the present day. This old ewe had one peculiarity, which may prove that such sheep are better mothers. She would own every lamb that was dropped, and would drive away the mothers of the lambs until she had one of her own.

The skin of sheep is composed of three textures. Externally is the cuticle, or scarf-skin, which is thin, tough, devoid of feeling, and pierced by innumerable minute holes, through which pass the fibres of the wool, and the insensible perspiration. It seems to be of a scaly texture. This is plain to be seen when the sheep have the scab. Below this is the rete mucosum, a soft structure, its fibres having scarcely more consistence than mucilage, and being with great difficulty separated from the skin beneath. This seems to be placed as a defence to the terminations of the blood vessels and nerves of the skin, and these are, in a manner, enveloped and covered by it. Beneath is the cutis, or true skin, composed of innumerable minute fibres crossing each other in every direction, highly elastic in order to fit closely to the parts beneath, and to yield to the various motions of the body. Judging from the mixture of wool and hair in the coat of most animals, it is thought by some that the primitive sheep had a hairy covering. It is said that there are at the present day varieties of sheep that are clothed outwardly with hair of different degrees of fineness, and underneath the external coat is a softer, shorter and closer one, that answers to the description of fur, but which really possesses all the characters of wool. It is therefore highly improbable that the sheep, which has now become, by cultivation, the wool bearing animal, should, in any country, have ever been entirely destitute of wool. Sheep of almost every variety have at times been in the gardens of the Zoological Society of London, but there has not been one on which a portion of crisped wool, although exceedingly small, has not been found at the bottom of the hair. The filament of the wool has scarcely pushed itself through the pores of the skin, when it has to penetrate through another and singular substance, which, from its adhesiveness and color, is called the yolk. It is found in greatest quantity about the breast and shoulders, the very parts that produce the best and most abundant wool, and in proportion as it extends to any considerable degree over other parts, the wool is then improved. It differs in quantity in different breeds; it is very abundant in the Merino.

The yolk being a true soap, soluble in water, accounts for the comparative ease with which the sheep that have the natural proportion of it are washed in a running stream. The fibre of the wool having penetrated the skin and escaped from the yolk is of a circular form, generally larger toward the extremity, and also toward the root, and in some instances very considerably so. When the animal is in good condition, and the fleece healthy, the appearance of the fibre is brilliant, but when the state of the constitution is bad, the fibre has a dull appearance, and either a wan, pale light or sometimes scarcely any, is reflected. As a general rule, the filament is almost transparent in the best and most useful wools, whether long or short.

When access to good city markets is convenient, and on high priced and high tilled farms, where sheep are kept in limited numbers, as part of convertable husbandry, improved mutton sheep may be bred very profitably. In interior situations, remote from such markets, the Merino, or fine wool sheep yield the best return. I think the best varieties of improved mutton sheep are the Cotswolds, being the largest and most prolific, and the improved Southdowns, the mutton of which has sold in England for years for three and one-half cents per pound more than other mutton. The Southdowns are the oldest established short wooled improved mutton sheep. It is said of the Cotswold ewes that they are better mothers, and furnish a valuable combing wool; choice flocks averaging about eight pounds of wool per head. In England Mr. Spooner says that the wethers fattened at the age of fourteen months weigh, dressed, from fifteen to twenty-four pounds per quarter, and at two years of age from twenty to thirty pounds per quarter. We have flocks in this State that will do even better than that. But of the improved mutton sheep that have found most favor in the United States, of the long wools, are the Leicesters, Cotswolds, and New Oxfordshires. Of the short and middle wools, Southdowns, Hampshire Downs, Shropshire Downs, and the Oxfordshire Downs.

Of these varieties agriculturists and sheep breeders generally give the Cotswolds and Southdowns the preference.

MERINO SHEEP.—The original importation of sheep into the United States, from England, France, and Spain, included all of the best varieties. The Saxon and Silesian Merinos are of later importation. History tells us that in Spain, over two hundred years ago, it was a crime punishable with death to allow a Merino sheep to pass its borders for another nation. And the Merinos to which Spain yielded up her title, were those procured by Augustus Frederick, Elector of Saxony, in 1765, which event was the beginning of the revolution of the wool trade of the world. After fifty years' breeding of these sheep, which were of the Escurials, came the Saxon Merinos. The first Merino sheep imported into this country were two pairs, sent from France by Robert R. Livingston, in 1802. The same year a much larger number was imported by Col. David Humphreys, of Connecticut. Wm. R. Jarvis, of Vermont, made importations in 1809, 1810, and 1811, which probably laid the foundation for many of our best flocks. And here, in old Vermont, the Merino sheep has found a home, where the Creator has provided all that is necessary to the progress and improvement of this most useful animal. A great variety of grasses, pure water, high pasture lands, good shades, and all the varieties of movement which the sheep has to make to procure its food climbing our mountain sides, has helped much the development of a most perfect animal; while our cold climate has given, by the aid of its breeders, a hardiness and constitution by far superior to the imported sheep from which our sheep of to-day have descended. Of the original Spanish families of sheep imported into this country, are the Infantadoes, Escurials, Negrettes, Monticos, and Paulers. These families include all of the best varieties of sheep which have been imported into this country from Spain, England, and France. Of all these importations, but two have been bred pure to the present day, and those are the Infantadoes, and Paulers; and the great reason that these two families have thus been preserved is, that they were found to possess more good qualities than the others, and much credit is due to the sons of Vermont for the application of their talent to this calling. Mentioning first the late lamented Edwin Hammond, who was honored by the title of king among sheep breeders, and then Messrs. Deans, Sanford, Cutting, Rich, Stickney, Wright, Robinson, Stowell, Binghams, Clark, Burwell, Cushing, Gleason, Bissell, Williamson, Chebrino, Fuller, Perkins, Benedict, Townsend, and a multitude of others which time and space will not allow me to mention.

IMPROVED INFANTADOES.—These sheep have been preserved pure to the present day. They are a fourth, if not a third heavier than their Spanish ancestors, and are the largest family of American Merinos. Some of them weigh one hundred pounds and some as high as one hundred and thirty pounds. They are much rounder in the ribs, broader and fuller in the quarters, shorter limbs, and stronger boned than the original Spanish sheep. They are models of fine wooled sheep in compactness and beauty of form. Their ability to travel is not as great as the original imported sheep. In the place of this useless ability to travel has been bred aptitude to take on flesh and grow wool, so giving by better breeding, better constitutions, and while easier kept, are longer lived, more prolific and more hardy. "They will thrive where mutton sheep would fail to find subsistence," says an eminent writer on sheep. The improved Paulers are naturally a little smaller sheep, consume less food, and, perhaps, can better endure deprivation of it. They are the poor man's sheep. They have the same improved points as the Infantadoes but are shorter bodied. As breeders and nurses they are equal, and their fleeces are equal in fineness. Some breeders have crossed these two classes with remarkable success.

The first thing to look at by a breeder should be constitution, as well in the sheep as in any other animal. Nothing can look worse and more worthless than an old sheep's pelt carried around on the skeleton of a sheep. A breeder of sheep should not endeavor to breed to any extreme, such as great length of staple or a great amount of yolk, nor try to breed too large an animal; a medium is better. Extreme wooliness of all parts causes the sheep to be smaller, and weaker constitutioned. But let the breeder aim to get a fair sized sheep, breeding for a staple of wool not to exceed two and a half inches, full chested, the fore limbs far apart, thus giving place for a better pair of lungs; then have the shoulders well rounded off, as well as the hip strong down on the quarters, with round ribs and a good depth of body. The character of the Merino and its fleece is improved in point of thickness by heavy folds about the neck, and a broad, wrinkled tail. The folds of the neck give the sheep a bold appearance; not extreme wrinkles all over the body, such a ewe, almost without fail, is a poor mother, giving but little food to her offspring. Good ewes may have heavy necks with folds, and good flanks with wide tails. The breeder should also breed for a fine haired nose, with a lustre to the hair; a thick, velvety ear, free from any dark spots; strong limb with large bone; well wooled, equal length and thickness of wool on the belly of the sheep as on the side or shoulder; also a sheep that holds a bold, high head.

It has been said by good breeders that there is no animal that has so many points to breed for, consequently requiring the more study. The sheep breeder, to be successful, should possess a good share of common sense and practice it. The laws of nature, to a sheep breeder, are the rules to abide by, and with these he may produce wonderful results.

No longer are the principles and rules of sheep husbandry a secret, for the generous spirit which prompts our sheep breeders of to-day enables the enquirer to obtain almost any knowledge by conversing with them. To illustrate how much improvement has been made, I will say that the original imported sheep sheared from two to four pounds per head, while whole flocks of to-day, with ordinary care, shear on an average from ten to fifteen pounds per head. Some extreme cases of heavy shearing in which ewes have sheared nearly twenty pounds, and our best rams from twenty-five to over thirty pounds. I can hardly believe that the breeders of former times expected to meet with such grand results.

We learn from facts derived from investigation that our sheep formerly possessed from 5,000 to 5,500 wool hairs to the square inch; of the fourth and fifth generations about 18,000; of the twentieth generation 27,000; showing a rapid progress. Our sheep of to-day have from 40,000 to 48,000 wool hairs to the square inch. Mr. Jeppe remarks in his report on wool, at Munich, Bavaria, in 1844, that upon a heavy fleeced animal he counted, on one-sixteenth of a square inch, 2,618 wool hairs, and on a thin fleeced animal 1, 018,and the wool was equally fine in both fleeces.

I am told that the past year has brought men from more parts of the country than ever before, which shows an increasing demand for Vermont sheep. I will give a few statistics of the sheep and wool productions of the principal countries in the world There are over 289,000,000 sheep, which produce nearly 1,000,000,000 pounds of wool, worth $302,660,000. And the United States produce 117,000,000 pounds of wool, and have over 32,000,000 sheep, whose wool is worth over $70,000,000. These amounts of wool are annual. In 1870 there were 2,891 woolen establishments, furnishing employment for 80,053 people. Vermont has sixty-five woolen mills. These statistics show the extent of this business throughout the world.

And in closing let me call your attention to the success of one boy, who early showed a liking for sheep. At the age of ten years he had the care of his father's flock of graded sheep, which, though often losing its best members by being sold, reached quite a high standard, averaging nearly eight pounds of washed wool. This boy raised a large flock of turkeys one year, sold them, and with the money bought a rifle. But the love of sheep was too strong for the rifle, for when an opportunity was offered to exchange the rifle for a full blooded Merino sheep, he yielded up the rifle. Having one full blooded ewe gave a still stronger desire for more, and purchasing ten bare faced, bare legged, inferior old culls, he struggled along, making other small additions, until, at the age of twenty-one, he found himself twelve hundred dollars in debt; but with constant study of his sheep and using all the good stock animals to which he could gain access; finding that heat propagated growth, also that sweet apples were well adapted to grow the carcass and fleece; keeping his breeders in good condition; giving his flock all the needed attention; constantly raising and improving and selling from his flock; taking the laws of nature as his rule; feeding according to the most natural demands of the sheep; giving a variety of food, the sweet apples taking, in a measure, the place of green food, in five years he found himself out of debt, and with more money in the bank than his first indebtedness, besides a fine flock of sheep. Sheep from his flock have been sold into almost every State in the Union. He salts his sheep twice a week; shears the first week in May;

his lambs come in April. He selects breeding stock possessing all the possible points ; weans lambs the last of July or first of August; feeds the lambs, when first weaned, a few oats every day ; begins housing the other sheep (except breeding ewes,) about the first of August, up to which time they run on the mountains. His success has been gratifying to his friends and most encouraging to himself.

MERINO SHEEP INDUSTRY.

BY COL. E. S. STOWELL, OF CORNWALL.

The time *has* been when one would need to *apologize* for introducing the subject of Merino sheep, even in Vermont, most noted for their improvement and culture in the United States.

But that time has passed, and the many are as anxious now to hear, as they were then opposed, and I only feel to apologize that I should be the one to introduce it. It seems so much like advertising my own wares that it is in a measure distasteful to me, and it is only through the persistent urging of my friends and a certain sense of responsibility, that has overcome my reluctance, do I consent to do it at all.

This industry is peculiarly subject, more than any other to sudden and enormous fluctuations. The market value of Merino sheep has, at different periods of their history, shown the most remarkable variations of any product of the land.

So much is this the case that in the minds of many it has become almost or quite a reproach. But this should not be. It is rather a commendation, for these variations, these hot and cold stages (as they may be called), are result-ant from the unequalized capacity of sheep for rapid increase and large profit.

The cold stages, the seasons of depression, have always been traceable to direct causes, either from lack of knowledge or change in the wants of consumers by fashion or otherwise.

To trace out some of these causes, and to learn from others' mistakes how to avoid our own, was the primary object of this history (if it may be so called), necessarily condensed and incomplete to be within the limits of such an occasion as this; and my only fear is that it is not now condensed to within the limits of your patience, which virtue I bespeak in the outset; for, believe me, had it been possible to have done justice to this very important interest in one-half the space, I should have been only too happy to have done it so.

From the earliest period of the world's history sheep have been domesticated and appropriated to the wants of man, and have ever stood in the foremost rank of essentials to his comfort and prosperity.

He has been food and raiment, the type of man's salvation even, in the gift of the "Lamb of God that taketh away the sins of the world." "Unto Adam also and to his wife did the *Lord God* make coats of *skins* and clothe them."

"Abel was a keeper of sheep, and brought the firstlings of his flock and the fat thereof as an offering unto the Lord;" and if, as Merrill has it, there is no authority for supposing that the flesh of the sheep was used for food until after the flood, the Divine permission was given unto Noah, "even as the green herb have I now given you all things" (for food); and even stronger unto Moses: "then shalt thou kill of thy herd and of thy flock which the Lord hath given thee, and thou shalt eat in thy gates whatsoever thy soul lusteth after;" and there is every reason to suppose that the milk of the ewe was eaten very early, as it has since been in various parts of the world, and is even now by the nomadic tribes of the East. "And He made him to suck honey out of the rock, * * * butter of kine and milk of sheep with fat of lambs and bulls of the breed of Bashan."

Burkhardt gives the following account of the manufacture of butter from ewe's milk by the Syrian Arabs: "The sheep are milked during the three spring months morning and evening. They are sent out to pasture before sunrise, while the lambs remain in or near camp. About ten o'clock the herd returns and the lambs are allowed to satiate themselves, after which the ewes belonging to each tent are tied to a long cord and milked one after another. The same process occurs at sunset. From a hundred ewes the Arabs expect in common years about eight pounds of butter per day."

But it is not really of the milk or meat producing qualities of sheep, but of sheep as a wool bearing animal that I purpose to speak.

I have made these references to show that we have Divine authority for putting a high estimate upon them as sheep; for even He shall set the sheep on his right hand.

The art of weaving and dyeing was understood in early days. Job says: "My days are swifter than a weaver's shuttle," and Joseph had a coat of many colors.

A writer on ancient manufactures says: "Modern historians have united in tracing the invention of weaving to the Egyptians," not of wool but of flax. The banks of the Nile were as unfitted by their overflow and their soft bottoms for the keeping of sheep then as now, and sheep, no doubt, were as unfitted for that kind of pasture; but though unfitted for sheep, they were eminently fitted for the production of flax, from which then and now the fine linen of commerce is manufactured.

But are the claims of the primitive shepherds fairly considered? The cultivation of sheep, as we have seen, was coeval with the expulsion from Paradise; and when Abraham sojourned in Egypt with his family and his flocks and his herds, how easy for him to have imported their skill, though he saved his wife, his silver and his gold.

The comparative histories of the primitive shepherds with the Eastern nomads of to-day, show so many points of resemblance and, withal, such tenacity to the traditions of their fathers on the part of the Arabic shepherds, whose customs are almost identical with those of the patriarchs, that it is fair to suppose them entitled to the credit of inventing the very simple process by which the Arabic women manufacture from the wool of their flocks now.

Burkhardt thus describes the loom at present found among the Arabic shepherds: "The Arabic women use a very simple loom; it is called *melou*, and consists of two short sticks which are stuck in the ground at a certain distance, according to the desired breadth of the *shauki*, or piece to be worked; a third stick is placed across over them, and over the two horizontal cross sticks the woof. To keep the upper and under woof at a proper distance from each other, a flat stick it placed between. A piece of wood serves as the weaver's shuttle, and a short gazelle's horn is used in beating back the thread. The loom is placed before the *mohorrum* or women's apartment, and worked by the mother and her daughter. The distaff is in general use among them, and among the Kibby Arabs all the shepherds manufacture wool."

It is probable that the covering of the primitive sheep was a mixture of hair and wool, very closely akin to that of many varieties now occupying extensive districts where the patriarchs wandered, northward and eastward, through a great part of Europe and Asia.

Says *Youatt :* "It is highly improbable that the sheep, which has now become, *par excellence*, the wool bearing animal, should, in any country, at any time, have been entirely destitute ot wool, but covered externally with hair and underneath with a fine, short, downy wool, from which the hair is easily separated." Partially by temperature perhaps, but mainly by breeding and cultivation, this hair has been caused to disappear and its place occupied, yea, more than occupied, by soft, clean wool, once of but few ounces, but now of many pounds.

In the palmy days of the Roman Empire the Italian sheep surpassed all others in the fineness of their fleeces. The sumptuous Roman was clothed in woolen fabrics of the finest texture, and fortunes, even according to the ideas of to-day, were often expended for his *toga*.

"The best wool of all others," says *Pliny*, "is that of Apulia and Tarentum, which is of very short staple, and especially in request for cloaks and mantles." This induced that extreme assiduity in perfecting the material for its manufacture. Says *Youatt:* "Although the old Tarentine produced a wool unequalled in early times, they were not without their defects, and very serious ones too. They were called by the agriculturists of those days *pellitte*, from the skins and other clothing with which they were covered; also *moles*, not only for the softness of their fleeces but from the delicacy of their constitutions and the constant care that was required to preserve them from injurious vicissitudes of heat and cold. The care bestowed upon the fleece was great. It was frequently uncovered, not only to ascertain its condition, but for the refreshment of the animal; it was drawn out and parted and combed if beginning to mat; it was frequently moistened with the finest oil and even wine; and was well washed three or four times in a year. The sheep houses were gorgeous and kept with the greatest care, being daily and almost hourly washed, cleansed and fumigated.

"The introduction of silk and cotton fabrics from the East, better adapted to the climate of Italy, caused the flocks of Apulia and Tarentum to disappear, to be succeeded by a larger, coarser but more profitable race, better suited to the time and place.

"In A. D. 41, Columella, a distinguished agriculturist, introduced many of the Tarentine breed into Spain. They had gradually spread from Syria and the Black Sea into Italy, and arrived at eminence. They bore a red fleece and were superior to all others in fineness. The Algerian sheep was white with an occasional out-crop of black; larger and coarser, and with an open fleece, much like the native Mexican of the present."

The Tarentine are considered to be the foundation of the Merino race, bred larger and to the white type, and the occasional occurrence of a red ear or red spots or red legs in the best of our flocks at the present day, would be somewhat corroborative.

In the eighth century the Moors conquered a portion of Spain, and " found it fruitful in corn and pleasant fruit, and glutted with sheep." This warlike and enterprising race were distinguished for their luxurious habits, and a fine and expensive wardrobe.

In the thirteenth century Spain became renowned for her woolen manufactures, Seville alone containing not less than sixteen thousand looms. Woolen manufacture became a source of great wealth, and sheep culture was exalted to the highest position of the land.

The Merinos of Spain were of two classes: the *Estoutes*, or stationary, and the *Trous hu mantes* or migratory. These latter were superior, probably from the weeding out process the Spanish shepherds had adopted from the Romans, as they did also their custom of keeping the sheep always in equable climate, and of subjecting them to a sweating process before shearing, to soften the crust formed on the end of the wool, and to make the whole fleece soft and pliable.

The practice of killing all lambs not possessing the proper characteristics, the ratio of which was probably not less than fifty per cent, the remainder having the benefit of two mothers, and the long journey of four hundred miles taken twice a year, in the spring to the pastures of Cervera, Navarre and the Pyrenees in the north, and in the autumn to the confines of Estremadura, Andalusia and New Castile in the south, tended to select only the strongest and best, and much of the noted hardiness of the Spanish Merino and its descendants is, no doubt, owing to this treatment.

So highly were sheep esteemed, and so powerful became their owners that they were able to force upon the people a most oppressive code, by a tribunal called the Council of the Royal Troop.

This code established a right for sheep to graze on all open and common land that lay in their way; it claimed, also, a path ninety yards wide through all enclosures and cultivated fields, and it prohibited all persons, even foot passengers, from travelling on the roads while the sheep were in motion. As the migrations were made at a season of the year when the crops were liable to injury, the damage must have been inestimable, and the prestige of the flockmaster unlimited.

In 1576 there were annually exported from Spain to France about forty thousand sacks of wool, at forty-five dollars per sack, and to Italy a finer sort at one hundred and twelve dollars and fifty cents per sack. But the Spaniards, in their bigotry, expelled many thousands of the Moors, industrious people, artisans; indeed, six hundred thousand in three years, and Seville's sixteen thousand looms dwindled to sixty. The glory of the Saracen had departed, and with it the woolen industry of Spain, and her sheep soon followed. Spain saw too late her fatal error, and France, Germany and the United Slates took advantage of it, although in different degrees.

Naturally it would be supposed that France, from her proximity, would be first to avail herself of the superiority of the Merino, and early been second to none for the beauty and value of her sheep and wool. Indeed, measures were in progress, at the opening of her sanguinary and sweeping revolution, to secure the prize, but that so far distracted the attention of the government and people that the only successful effort of national importance was the flock known as Rambouillet.

This flock gradually increased in numbers and quality, fostered by the government and that fine care which has made the French system so renowned ; the average weight of fleece being raised from six pounds nine ounces in 1791 to nine pounds in 1801, a period of ten years, and to fourteen pounds for rams and ten pounds for ewes in the next twenty, and in softness, fineness, length and strength of fibre it was second to none.

From that time to the present the strides of sheep, wool and woolens of France, fostered by a discriminating and enlightened policy of the government and people, have placed her high in the scale of excellence among the wool nations of the earth.

"To nothing," says Mr. Hayes, Secretary of the National Wool Manufacturers' Association of the United States, in an address before a convention of woolen manufacturers and wool growers, "is France so much indebted for the beauty and brilliancy of her woolen fabrics as to the perfection of her wool fibre, secured by the skilled breeders of Merinos, under the protection of a discriminating government believing in a 'mutuality' of interest between wool growers and woolen manufacturers."

I am not here for the purpose of promoting the interest of French sheep in this country. *Mene mene tekel upharsin* has been written on the wall over against them in time past. I believe them to have excellencies, however, and a modification of their characteristics by experience and skill, or, perhaps, a change in the American system of keeping, may serve to erase the verdict now standing against them.

What France lost by delay Germany gained. In 1764 the Elector of Saxony obtained, by special negotiation, a grant for two thousand Merinos to be taken out of Spain. They were accompanied by Spanish shepherds to instruct the Saxons in their care and management. A commission was appointed to superintend and direct the concerns of the sheep establishment; to spread all the information they could obtain before the public; and, by every means in their power, to induce the sheep owners of the country to improve their flocks, even to compelling the tenants of the government domain to purchase yearly a few fine bred Merinos. At first there was much prejudice, and improvement was slow; but "when the commissioners had exercised their functions ten years, the call for young rams was so great that they resolved to petition government to make another importation of ewes and rams from Spain."

Merrell says: "The invaluable properties of pure Saxon wool, and the consequent demand for its manufacture into fabrics, the fineness of which the world has never before produced, is the cause of the high value of Saxon sheep and their spread over so large a portion of Europe and remote parts of the world."

No other breed were so highly prized on the Continent, and none commanded such enormous figures. "Individual sheep, of uncontaminated blood, often brought from one hundred and forty to two hundred and fifty dollars; a flock was purchased, destined for Russia, a few years since, for which the average price paid exceeded five hundred dollars; and latterly rams have been sold at the almost incredible price of from one hundred to near three hundred guineas per head. The cause of these extravagant prices has been stated; and so long as there exist grades in society, and the highest of these covet a wardrobe of the finest texture, and no substitute is found, as in Italy, the breed will continue to be appreciated and sedulously cultivated."

It would expand this paper too much for me to detail the introduction of Spanish Merinos into other parts of Germany, Prussia, Austria, etc. Suffice it to say that many districts rival Saxony; Prussia, especially, fosters her flocks, and not only by premiums bestowed by her agricultural societies, but by that enlightened policy of protection to domestic industry which so truly characterizes that government, even to the prohibition of manufactured goods imported, and the export of their raw, unmanufactured wools; and, probably, in no one thing, not even in arms, has Prussia advanced more during the last twenty years than in her wool and woolen interests, under the most successful workings of her prohibitory tariff.

But the high positions of the woolen industry of these countries has not been reached without mistakes, trials and struggles.

Fleischman divides the history of Merinos in Prussian Silesia into five periods. From 1785 to 1805 was the introductory period, " when the wool growers were ignorant in the knowledge of wool and management of Merinos." From 1805 to 1815 was the period " when the difference between Merino and common wool began to be understood, and the wool growers travelled for information and brought Merinos from Saxony." From 1815 to 1825 was the third stage. " The great desire was for extreme fineness ; they overlooked many other valuable qualities, as size, shape and constitution of the animals. With the highest degree of fineness great softness was required. The Saxon breed, Electorals, combined these qualities ; they were employed in crossing, consequently the finest Silesians consisted of thin fleeced, delicate animals which, besides a deficiency in wool, were liable to all sorts of diseases.

"The period from 1825 to 1830 may be called the test for German wool growers, and particularly for the Silesian. In that period the price of wool sunk so low (it appeared as if England had taken leave forever of the German market,) that many were affrighted and began to diminish their flocks, and change their whole system of farming. It produced a crisis, and their attention was principally directed to an increase of wool in the fleece, to compensate for the loss sustained in the prices. This crisis operated very beneficially upon the whole system of breeding Merinos ; the wool growers, instead of aiming at the highest degree of fineness, have now a greater quantity of wool in view.

"Finally came the fifth stage which had for its object to produce not only the finest and softest wool, but in great quantities." And for aught I know the Prussians have since added in the sixth stage, what their sheep, when last heard from, lacked to be a practically good sheep for the American market, (when our upper classes sustain their manufacturers in wanting fine wool,) to wit: form, and an animal that will stand a moderate degree of exposure without vanishing like the morning dew.

The first importation of sheep of any importance into the United States were French, in 1802, by Chancellor Livingston, American Minister to France. They bore but little resemblance to the modern French, and were probably genuine Spanish Merinos before changed in form and constitution by the French system of breeding and keep. So successful was Mr. Livingston that he sold ram lambs of his own breeding, in 1810, for one thousand dollars each, and sheared from a full blooded ewe the enormous fleece, for those days, of eight pounds and ten ounces, and from a yearling ram of his own breeding, eleven pounds and nine ounces of wool in the grease, nearly three pounds more than from the heaviest shearing of his imported stock.

Later in the year 1802 Colonel Humphrey, American Minister to Spain, brought home to this country twenty-one rams and seventy ewes, purchased for him in the *cabanas* of Leonesa Traushu montes of Spain, supposed to be Infantadoes. These *cabanas*, or families, such as Infantado, Paular, Gaudaloupe, Nigrette, Escurial, Aiguerras, Monterco, Arriza, etc., were subdivisions of the choice "Traushu montes," or travelling sheep of Estramadura, New Castile and

Leon, and presented characteristics indicative of the peculiar tastes and skill of their owners and breeders, from whom they took their names.

"In 1809 and 1810," says *Randall*, "Mr. Jarvis, Consul at Lisbon, Portugal, taking advantage of the offers of the Spanish nobles, bought and shipped to different parts of the United States about three thousand eight hundred and fifty sheep. About thirteen hundred of these were Aiguerras, two hundred Escurials, and two hundred Montercos. The remainder consisted of Paulars and Nigrettes, mostly of the former."

At this period Merino sheep bore a very high price, as has been before remarked of Chancellor Livingston's. One hundred dollars per head was not uncommon, and one thousand dollars occasional.

Andrew Cock, of Flushing, Long Island, in 1811 paid to Richard Crowningshield, importer, eleven hundred dollars per head for two ewes of the Escurial Cabana; but the major part of his flock were from the Paular, and purchased at from fifty to one hundred dollars per head the same year.

In 1815 the treaty of Ghent removed the embargo, re-opened commerce, checked by our war of 1812, with England, admitting cheap labor manufactured foreign goods free, thus destroying, at one fell sweep, the infant manufacturing industry of our own country, and with that, as in Spain, away went sheep. *Randall* says: "Such revulsion ensued that before the close of the year full blooded Merino sheep were sold for one dollar per head," and wool at almost nothing.

"Wool did not materially rally in price for the nine succeeding years, and during that period many of the full blooded flocks of the country were broken up or adulterated."

The woolen tariff of 1824 gave new life to the production of fine wool, and for a few years Saxon Merinos were largely imported into the United States. "As many as seventeen hundred were brought into the port of Boston, and nearly or quite as many into other ports. Some of them, selling as high as from four hundred to four hundred and fifty dollars per head, were of fine blood, but very many were low "grade," and the great majority miserable "stop sale sheep," as they were called in Germany, and brought along with them scab and foot-rot, and, from all accounts, about all the ills the Merino race are heirs to.

These sheep sheared a fleece of fine, downy wool, of from one and one-half to three pounds, but so destitute of oil that the ordinary exposure of the country would cause it to "cot" on the sheep's back, and the ends to become dead and dry. Such wool "flies" and wastes in the manufacture, indeed becomes worthless, often, for other purposes than mats or saddle blankets. I remember, when a boy, of seeing one of these "cotted" fleeces, as they were called, that had been used for years as a "sheep-skin" under the saddle, and there was no appearance then of its "felting" power relaxing. Boys on the shearing floor used to have great fun hauling one another about the floor in their vain endeavors to pull one of these tenacious fellows apart.

In 1828 the fine wool tariff "excited a mania," and every producer strove to obtain the finest wool regardless of every other consideration. Manufacturers went through the country offering large prices for fine wool, drawing bright pictures of the brilliant future of those who had to do with the growing or manufacturing of it. Owners of Spanish Merinos were over-persuaded, and many who had carried along their pure sheep under every discouragement yielded now, and fell into the mad torrent of Saxony sheep, and rushed along down the stream with the rest. There was an "ignorance of the knowledge of fine wool breeding," and of the demands of the American market for woollens. We had no large upper class "to covet a wardrobe of the finest texture," and our manufacturers were not sustained; and failing to get that support they had fondly anticipated from home, and receiving no foreign orders, were unable to pay the prices they had led growers to expect. A reaction took place after the crash of 1837, and culminated in the final overthrow of Saxony sheep in America with the horizontal *ad valorem* tariff of 1846.

"In 1813 Stephen Atwood, of Woodbury, Connecticut, bought a Spanish Merino ewe, of Colonel Humphrey, for one hundred and twenty dollars. This ewe he bred to Humphrey's rams, or rams he knew to be of pure Humphrey blood, until 1830, when he bred from his own flock." At this time pedigrees of the old fashioned Merinos received very little attention. Mr. Atwood alone, in his respect, we might almost say veneration, for the Humphrey sheep, having once lived with Colonel Humphrey, and formed his taste from his flock, adhered to them in opposition to the opinion and practice of every other sheep breeder that was then, or has since come prominently before the public, except Hon. Charles Rich, of Shoreham, Vermont. He, with Leonard Bedell, of the same town, purchased, in 1823, of Andrew Cock, of Flushing, Long Island, a flock of Paular Merino sheep; and the Rich sheep have, undoubtedly, been bred pure since, although they have taken crosses of Jarvis and Atwood rams.

In 1840, the downfall of Saxons being assured, an account of stock showed the following results:

The Jarvis sheep had been largely crossed with Saxons; a small part remained in which the fine families, originally imported, had been mixed, the greater proportion being Paulars, although, for the purpose of accommodating the manufacturers, and also following out the leading idea of the day, Escurial rams had been chiefly used, and the sheep bred "in a contrary direction from the type of the darker colored and yolkier families." They were, therefore, light colored, rather rangy sheep, many having the thin, high shoulders, Roman nose and bare face and legs of the German, and, barring legs and face, the Silesian. "These sheep," says Randall, "are now represented in pedigrees of many excellent, pure bred flocks, but as a distinct sheep they have been mostly merged in the Paular and Atwood families.

"The Paulars, in 1840, were heavy, short legged, broad animals, full in the quarters and strong boned, with thick, short necks, and coarse heads. The ewes had deep, plaited dewlaps, and folds of moderate size about the neck; the rams had larger ones. They were darker externally than the Jarvis sheep, but not so much so as the Atwood. The wool was longer than that of either of the other families, very thick, and covered them better on the belly, legs and head, but was inferior in fineness, evenness and style, and was quite coarse on the thigh and neck folds, the yolk thick and of a golden color.."

"The Atwood sheep in 1840 were larger than the Paular, and, like them, had heavy dewlaps and some neck folds and wrinkles. Their wool was shorter, finer and evener, well crimped, brilliant, thick and very dark externally. The inside yolk was abundant and generally colorless."

There were a few other small Merino flocks scattered through the States, but as they have failed up to this time to make any note of themselves, and probably have all been merged in either the Paular or Atwood families or both, ere this, we will pass them by with the remark that the model ewe of Mr Francis Rotch, of Louisville, New York, an eminent sheep and cattle breeder of 1840, from his flock of thirty ewes, "selected from the best New England flocks," as illustrated in the *Practical Shepherd*, shows a plain, bare faced, bare legged ewe, absolutely without dewlap or folds of any kind, and a sheep unworthy of a place in a fourth rate flock of culls of the present day.

The French sheep were represented by a small importation by Mr. D. C. Collins, of Hartford, Connecticut, who, seeing the government flock at Rambouillett, while travelling in France, and appreciating the great deterioration of the sheep of America, and the excellence of these, conceived the idea of breeding rams to restore the sheep of his own country to their former excellence.

In fact the desire was cosmopolitan to return to the old fashioned Merino or something better in the same line.

But alas! but few of the old landmarks remained, and those in a ruinous condition.

In 1844 and 1846 Mr. Edwin Hammond, of Middlebury, Vermont, purchased of Stephen Atwood, of his pure Humphrey Merinos, in three several purchases, the basis of his flock, since so widely and justly celebrated; and for twenty years he and his cotemporaries, both in the Atwood (since called Infantadoes,) and the Paular branches of the Spanish Merino, made rapid strides in improvement; an improvement by "their perfect understanding and exquisite management of their material," as great as that of Bokewell, in the coarse wooled sheep of England, or Bates, in the improved "Shorthorn." They converted the thin, light boned, smallish and imperfectly covered sheep that they found, into large, round, low, strong boned, well covered animals; "models of compactness and beauty, in form and character," with which you are all so conversant; and a fleece such as the world never saw before; a fleece to which the famed "Golden Fleece," for which Jason sailed the world over, bore no comparison; a fleece with a long, strong, lustrous, even, elastic fibre of the utmost quantity, holding its quality even upon head, flank, legs and belly, compact, and fine to the touch; "opening like a book," and showing a soft, mellow, pink skin, between the cream tinted and water lined leaves.

Early in this period the profit of breeding Spanish Merinos was not large; far from it. The American people had been misled and lost money in sheep. To be sure, they were Saxony, and their loss was owing to the unfitness of those sheep to the American market, and the stupid policy of building up the commerce of a country at the expense of her manufactures; the traders, the middle men of a country, at the expense of her producers and consumers.

The people moved slowly, and so the breeders, but surely. They were creating, from but meagre materials, a race, a breed; and a wonderful one it was; but the people didn't see it, the change was so gradual. Suddenly a bright light appeared like a meteor flash! The Taintor importations of French Merinos, those huge models of bone and corrugated skin, with their gross but uneven fleeces, struck the eye, and the American people were thoroughly awakened and, with their characteristic unification, rushed pell mell into their purchase, sometimes, I have thought, from the sheer force of contrast; alas! to be again disappointed. The French Merino was as much too much of a good thing as the Saxon was too little.

Meanwhile the breeders of Spanish Merinos pursued the even tenor of their way, catching, it may be, an inspiration from the advent of such a striking model as the French sheep presented, and availing themselves of the true breeder's prerogative of moulding according to will, and to almost any type in form, in fleece, and all that goes to make up the perfect sheep, they reached, it would seem, the highest point, the very acme of their art, and that too by judicious selections, and crossing within the limits of their own flocks and families.

To such an extent were their improvements carried that, when the prestige of the French was lost, the awakened mind of the American people was ready to receive the improved Spanish Merino as the sheep best adapted to their wants, a sheep that showed itself possessed of all the merits of the French Merino without its defects.

The profits were bountiful and the harvest large, increased and enhanced, it is true, by our civil war, until the demand was greater than the supply, and prices such as sheep had never reached before. Don't blame the breeders for that; their prices were their protection. Too large, says one. Aye, too large they might have been; but they were for a real thing, an article that was truly and demonstrably meritorious. For a sheep was produced that yielded a pound of wool in the grease to four pounds of carcass, and a pound of clean, scoured wool, fit for the cards, to a little over twelve pounds of carcass, and that, too, so fine and even that nearly one half was of one kind, known to the trade as No. 1; a wool that enters most largely into the manufacture of the best American cloths. Individual sheep sheared as high as twenty pounds for ewes and thirty pounds for rams per head.

Flocks of pure Spanish Merinos were established in many parts of the country, breeders buying a few ewes and their stock rams in Vermont, often replenishing their stock, as they could afford (for these sheep were costly, and the good ones are yet), in the laudable endeavor to become the ram breeders of their own sections, and improve the large flocks of grades, and re-Spanish the many flocks of Saxons; raising the average from two to six and even eight pounds of wool per head, for large flocks kept for the purpose of wool-growing alone.

But even this had an end, for after enjoying this unprecedented prosperity until about 1865 or '66, the over production, stimulated by the failure of the cotton crop in the Southern States during the late rebellion, created a reaction of the American market, not alone, but every other wool center of the world, because so enormously overstocked that utter ruin and annihilation stared wool growers and manufacturers alike in the face. But they were not to be driven to the wall without an effort. They met in convention in Syracuse, New York, in December, 1865, coming from every part of the loyal States, big with the importance of their undertaking, a common danger making a common cause.

I cannot do better than to quote the Hon. John L. Hayes, in his second address to wool growers and manufacturers, at Syracuse, in December, 1871. He says:

"The convention of 1865 is memorable, among other things, for the conflicting sentiments in the woolen industry which preceded and was the cause for invoking it. A difference of opinion, amounting to actual hostility, between the two interests supplying and manipulating the raw material of our woolen mills, had been gaining strength for fifty years, and had assumed the phase of sectional animosity between the East and the West. On the one hand, the West, representing the wool growing interest, exaggerated the profits of the Eastern manufacturers; claimed that it bore, without compensation, the burden of the duties which promoted their profits; ignored the fact that the specific duties on foreign goods competing with our own were but the equivalent for duties on the raw material, which the wool growers received, and demanded the mis-called equality, so obnoxious to the manufacturing interests, under the horizontal tariff of 1846. The manufacturers, on the other hand, representing a growing sentiment at the East, were becoming more and more disposed to look abroad for their chief supply of raw material.

"They were not unwilling to avail themselves of such commercial practices as would diminish the duties intended to be given for the protection of the American wool grower, and were inclined to advocate the British policy of free trade in raw material, including wool, as the wisest system of protection to manufacturers.

"They overlooked the fact, which they have since acknowledged with returning magnanimity, that it has been the experience of all nations that the domestic supply of raw material has been the first and always chief dependence of its manufacturers. They failed, also, to consider that while aiming at the largest and cheapest supply of foreign wool, they would render American sheep husbandry unprofitable, and inevitably destroy domestic production, thus reducing themselves to a sole dependence upon resources liable to be cut off by foreign wars or political revolutions.

"The inevitable result of such diverging views must have been perpetual strife and legislative action, which favoring each interest exclusively, as its influences might preponderate, must alternately ruin both. From this explanation of the old differences which formerly distracted the woolen industry, it can hardly be doubted that the disaffection toward the prevailing policy exhibited by a limited number of the older wool growers, is but the expression of the traditional hostility in which they were nurtured.

"The convention of 1865 is chiefly memorable for its influence in reconciling this disastrous feud. This influence was the result of the simplest means, nothing more than to bring, for the first time, face to face the interests which had been prejudiced and hostile only because they misunderstood each other. A conference of but a day between the rival interests was sufficient to establish a basis of adjustment. This basis was the recognition of 'mutuality' of interest and a right to equality of protection."

The principles upon which harmony might be established were expressed in the resolutions unanimously adopted by the convention, which have an historical value as the first joint expression of the wool industry of the country. They are as follows:

"*Resolved*, That the 'mutuality' of the interests of the wool producers and the wool manufacturers of the United States is established by the closest commercial bond: that of demand and supply; it having been demonstrated that the American grower supplies more than seventy per cent. of all the wool consumed by American mills, and with equal encouragement would soon supply all which is properly adapted to production here; and, further, it is confirmed by the experience of half a century that the periods of prosperity and depression in the two branches of woolen industry have been identical in time, and induced by the same general causes.

"*Resolved*, That as the two branches of agricultural industry represented by the woolen interest involve largely the labor of the country whose productiveness is the basis of national prosperity, sound policy requires such legislative action as shall place them on an equal encouragement and protection in competing with the accumulated capital and low wages of other countries."

Thus these traditionary antagonists united on the basis of "mutuality" of interests, and together they went before Congress for a revision of the tariff that would suitably protect the woolen industries of America.

"Unfortunately," says Bigelow, "they did not succeed in getting it in the session of 1865 and '66, and in anticipation of its passing the next session, seventy million pounds of wool and woolens, almost equaling the entire imports of the four preceding years, were imported under existing low duties. Such an importation, together with the action of government in throwing quantities of soldiers' woolen clothing upon the market at prices less than the cost of the material, terribly oppressed, but did not quite annihilate our woolen industry; the tariff was secure and a general prostration averted."

Had the large surplus of wool and of woolen fabrics, produced to take the place of cotton, been thrown upon our market after the close of the war, under the provisions of the previous tariff, these industries, wool and woolens, these sources of national wealth, would have received a shock from which recovery would have been reached, ir at all, only through a long period of distress and embarrassment.

The increase from 1861 to 1867 has no parallel: in Australia 34,000,000 pounds, or one hundred and six per cent.; in the Cape of Good Hope 10,000,000 pounds, or two hundred and fifty-eight per cent.; in La Plata 48,000,000 pounds, or two hundred per cent.

With the close of the war and return of the cotton supply, wool declined, Meetiza at least forty per cent., and sheep in South America from two dollars to fifty cents per head. In 1866, under the low duties on wool, 36,760 bales were imported into the United States from Buenos Ayres and the Cape of Good Hope alone.

In 1867, under the joint tariff of growers and manufacturers, 30,175 bales less. What a commentary upon its efficiency! Yet cavilers say "what good did your alliance do, or your wool growers' association either?" This comes now even, from the lips of startled politicians or their satellites, as an argument against any association whatever for farmers. Well enough for a few aspirants for office to secretly band themselves together in a "close communion conclave," to feel one another's pulse or "scratch one another's backs," as the case may be, *a la Tweed;* but for farmers, oh! no, they had better attend to their farming.

But didn't it do good? It stayed the tide of import, as we see, and and reduced the price of wool so low in Australia and South America that it would not pay the cost of shearing and carting to the sea coast. "Millions of sheep were slaughtered there for their pelts," a condition of things so improbable that it had not been provided for in the tariff of '67, and under a provision to admit Angora goat skins for manufacture into mats, they were imported into this country with three years' growth of wool on, at the specific duty of three cents per pound, thereby creating, as it were, a new trade, one that looked disastrous to wool growers at first, for it depressed the price of wool, and delayed the consumption of the great surplus already on our market. Second thought, however, gave it new light and promise—fleeces thus disposed of could not be duplicated—the flocks were sold out, and the pastoral sheep husbandry of Australia and La Plata was transformed to our own California and Colorado. The exports and consumption of wool of California in 1870 amounted to 23,557,871 pounds; whereas the total product of our whole country in 1830 was only 52,516,859 pounds. We can thus see at a glance that the wool interest of California in 1870 was no small item; and to-day it is doubled and, perhaps, more, I know not; but this I know, that the call for Spanish Merino sheep is loud and strong, and that already the traditionary struggle for supremacy is rife, and the eyes and hearts of the California flock masters are turned towards Vermont for that improvement that others have found here, and can find still. True they are looking for a little larger sheep than experience has shown best for others, and it is not to be wondered at; our fathers fell into the same error; but the experience of the last twenty years, and the testimony of the Hammonds, the Stickneys, the Sandfords, the Randalls, the McConnels, the Flints and the Hoyts all go to to show that the best pastoral sheep for our broad Western fields, our Eastern hill sides and Southern slopes, is the improved Spanish Merino of the Atwood or Paular families, and "Vermont type."

The American Merino of to-day, as we breed them in Vermont, present the excellencies combined, sought out by the necessities of former people, and brought out by the art of their time.

Thus we have the white sheep of the primitive shepherds; the fine sheep of the Roman empire; the hardy sheep of the Spanish *Troushu montes*; the even sheep of Prussian Silesia; the wrinkly, well covered sheep of the Taintor importation, and Paular caban; with the fine style and free oil of the Atwood, a sheep that needs no covering, no oil or wine to lubricate its fleece to render it soft and pliable or protect it from the "cotting" so detrimental to the Saxons, the Silesian or the French, under exposure; in fact, an American sheep for the American manufacturer, to meet the wants of the American citizen, in one grand "*commune*" and "mutuality" of interest.

FEEDING AND FATTENING SHEEP FOR MARKET.

BY HENRY LANE, OF CORNWALL.

There are somewhat over one million tons of hay harvested in Vermont annually. Of this amount, there are fed to horses kept in the State for road, draft, or farm purposes about 200,000 tons. To the cows kept for family or the various dairy purposes, nearly 400,000 tons. To neat cattle and sheep, for breeding or the growing of wool, about 200,000; leaving from 200,000 to 300,000 tons of hay to be disposed of annually, as the producer may think, when each crop is harvested, will bring him the most money.

Over large portions of our State the surface is so uneven that many if not most farms have more land suitable for pasturing than mowing, can summer more stock than they can winter. Along some of our streams, the intervals, and especially in the Champlain valley, the lands are suitable for mowing; and farmers that have good natural meadow lands generally think such lands more profitable kept for hay than pasturing, and consequently cut more hay than they need to keep the stock summered on such farms. I am one of this class of farmers; I can keep about twice the stock in the winter that I summer. This class of farmers, at the close of each haying season, ask themselves the question, How can I turn my surplus of hay into the most money; sell it in the market of our large cities and manufacturing towns, or purchase some kind of stock in the fall, winter it, and sell in the spring? The high price of hay in the market, previous to the past two years, has drawn the most of the surplus hay out of the State. The amount shipped for the past few years is numbered by the thousands of tons, where but hundreds were taken twelve or fifteen years ago.

A farmer following mixed farming, as I do, should look beyond the immediate cash return from a crop of hay. Manure I must have, to succeed in my mode of farming. The special fertilizers, scattered throughout the State in abundance, are high in price, and very uncertain in value. The question with me (and I think it should be with most farmers,) is not, shall I sell my hay, or feed it to stock, but what stock can I purchase in the fall, feed my hay and grain, and make me the most and best manure. And for a term of years, I find my best average returns are from feeding sheep, for mutton, for the city market. By feeding cattle, for beef, I could not get the value of my feed; by feeding sheep, with a single exception, I have received full value, and, in most cases, a little profit, besides the manure, which to me is the same as money (and I find manure made from grain fed animals the very best). I tried raising, or feeding, three classes: early lambs, lambs coming one year old, and full grown wethers. Ages between one and four years old are not good feeders, unless some of the long wooled or mutton varieties. In deciding which of these classes to feed, the farmer must be governed by circumstances. Early lambs, to bring the best price, should be dropped as early as February. In this climate, one must have very warm sheds, if he expects to succeed. Then, again, lambs require more time and care, which should be taken into the account. One must be willing at all times, even if it is to lose part of a night's rest, if necessary, during the lambing period, to attend to the various and numerous duties that require his care, and generally he must have the care himself. There are but few hired men that it would be safe or profitable to trust it with. Early fed lambs require more shed room. For fifty ewes it requires a shed 20 by 60 (or an equal space), two-thirds of this room for the ewes, one-third for the lambs, to feed by themselves after they are two or three weeks old. The same shed room will accommodate one hundred yearlings, or eighty full grown wethers. Yearling sheep require nearly as much grain as full grown wethers, but will consume but about half as much hay. All these things must be taken into consideration, together with the prospective market, when one decides what class of sheep to feed. For breeding ewes for early lambs, I prefer the grade Merino, avoiding the wrinkly, short, gummy wooled ones, selecting those of a vigorous constitution, broad, wide hipped, short legged, tendency to early maturity, prolific breeders, and good milkers, of an age not less than three or more than six years. Such a selection requires good judgment. To serve the ewes, I prefer a Southdown ram to either a Leicester or Cotswold. Rams should be put with the ewes in September, that the lambs may be dropped in February. It takes about ninety days to make a lamb of sufficient size and fatness for market. At this age, should weigh sixty lbs. When the lambs are two or three weeks old, they should have part of the shed partitioned off, nailing pickets just wide enough to let the lamb in and exclude the ewe. Racks and troughs should be placed to feed early cut clover, and a little oats, corn and oil meal fed on fine chopped roots. Feed the lambs first. After they have passed into their part (which they will learn to do very soon), close the entrance, and keep them by themselves while the ewes are eating their hay or grain, as lambs annoy their mothers if with them at this time. The ewe should have food that will keep up her condition and produce an abundance of milk. During the suckling period, she needs as heavy feeding as a grain wether when fattening. Corn to keep her in flesh, oats, bran, oil meal, buckwheat, and a free feeding of roots to produce milk.

Two years ago, I weighed a few of my lambs once a week, to ascertain their gain. I will give the weight of one, which will give about the average gain. Lamb dropped February 9th, weighed 8 lbs.; Feb. 19th, 13½ lbs.; Feb. 26th, 17½ lbs.; March 5th, 21¾ lbs.; March 12th, 24½ lbs.; March 19th, 26¾ lbs.; March 27th, 31¾ lbs.; Apr. 2d, 35¾ lbs.; Apr. 9th, 39 lbs.; Apr. 16th, 42 lbs.; Apr. 23d, 45½ lbs.; Apr. 30th, 49 lbs.; May 7th, 54 lbs.; May 11th, 56 lbs. At ninety-two days old, deducting the weight at birth, the gain was 48 lbs., a trifle over one-half pound per day. My ewes were too old to be good milkers; the lot should have been at least 10 lbs. heavier. The fleece should bring $2, and the lamb $6, making $8 per head. Lambs for feeding the winter and spring they are one year old, need not be dropped until April. During the last part of the fall, by the middle of October, I commence feeding this class of sheep, giving, during the month of November, grain liberally, and they should have access to a daily feeding of hay. The food for this class of sheep should be fat and flesh forming substances, such as will produce growth as well as fat. To full grown sheep, feed corn; to lambs, oats, peas, corn, and bran; and I think it pays to raise roots to feed any fattening sheep. I like a grade Merino the best to feed at one year old. Select those that are not large. Sheep of this age that are well fattened, weighing seventy or seventy-five pounds, will bring as much per pound, and often more, than those weighing one hundred pounds, the smaller ones selling as early lambs. This class of sheep, generally, are more profitable to feed than full grown ones, for three reasons. The first cost is not more, and sometimes is less per pound, the gain is greater on the same amount of feed, and the selling price higher per pound. From my sheep book I copy the following: Forty-four yearling grade Merinos cost, in the fall, $2 per head; average weight December 1st, 55 lbs.; sheared and sold April 15th; average weight after shearing, 72 lbs.; gain, in 4½ months, 17 lbs.; sheared 225 lbs; sold for $5.25 per head, including wool. Two winters ago, I fed a lot of half grade Cotswolds; average weight, when commenced feeding, 50 lbs.; cost, 6 cents per pound. January 8th, average weight, 62½ lbs.; February 16th, average weight, 69 lbs.; March 30th, average weight, 75 lbs. Sold at that time at 8 cents per pound, or $6 per head. The past winter, I fed 104 lambs, half-blood Cotswolds. From December 1st to April 1st, one hundred and twenty-two days, I fed 9,100 pounds of grain of the following variety and proportion: To each 100 pounds, 65 pounds was corn, 25 pounds oats and peas, and 10 pounds bran. Nearly all the grain fed was ground:

Weight of lambs.	Time between each weighing.	Gain.	Av. per head.
Dec. 3, 7034 lbs.			67 66-104
Jan. 4, 7633 "	32 days.	599 lbs.	73 41-104
Feb. 6, 8154 "	33 "	521 "	78 42-104
Mar. 11, 8985 "	34 "	831 "	86 41-104
April 1, 9505 "	21 "	520 "	91 41-104

During the month of December, I fed 50 pounds of grain per day; first fifteen days in January, 60 pounds; last half of the month, 70 pounds; from February 1st to 20th, 80 pounds; from the 20th to March 10th, 90 pounds; the remainder of the time, 100 pounds per day.

Yearling sheep, with the grain they require to fatten well, will not eat more than nine tons of hay per hundred up to April 1st, about the usual selling time. When feeding grown wethers, feed liberally in November. If you have grain for but one month, feed it during this month. There are two ways of feeding this class of sheep; each has its advocates. First, after feeding through November and till well on to hay, leave off the grain gradually until, a few days into winter, it is entirely omitted; commencing again about the 1st of February with a light feed, increasing gradually until they are fed on one and one-half bushels of corn per hundred, closing on two bushels; feeding one bushel per head during the months of February and March. The pinching cold weather of December and January tell upon the vitality of sheep, and unless the feeder has warm sheds, and good hay and water, with fine care, they will lose without grain. I claim that the fattening animal should have a continual gain, from the first feeding until ready for the butcher. I prefer feeding through the months of December and January, commencing with one bushel of corn per hundred per day, and increasing gradually throughout the winter. A change from food of store to fattening sheep, from that which is barely capable of supporting the condition which they have already attained to that which is adapted to their speedy improvement in fattening, should be gradual and progressive; if the food this month is to be more than that of last, let the change be gradual, commencing with the last week of the past month and continuing into the first week of the present with that increase.

GENERAL RULES.—There are certain general rules that I think should be observed in selecting and feeding sheep—rules essential to success. I will mention some of them. First, we select a sheep that has a hardy and healthy constitution.

In a climate as rigorous and changeable as that of Vermont, it is essential that our stock of sheep should be hardy, to endure the severities and vicissitudes of the weather. Breeds are different in this respect, and there is a great difference in animals of the same breed. The desirable qualities of sheep destined for feeding for their meat, are size, hardiness of constitution, quietness of disposition, quality of flesh, disposition to fatten; and if for breeding, prolific properties. We must look more to the cost of food in feeding than to the amount the animal will bring in the market; that is, the animal that will bring the highest price in the market on account of size and weight, may not pay as much, on the food consumed, as one of a small or medium size. Early maturity is another essential quality. When sheep are bred for the carcass, the sooner they become fat, the sooner they return the price of their food with profit, to the feeder; and, as a general rule, with greater profit for the food consumed.

REGULARITY IN FEEDING.—Sheep are good time-keepers. They know the very moment their food should be supplied, and are disappointed if it does not come. The sheep-feeder, therefore, should see that regularity and promptness prevail in the care and management of his stock. I know from experience that, when one has a newspaper or book in hand, in which he is interested, and is in warm quarters by the fireplace, he is very apt to let a half-hour or an hour pass, while his sheep are hungering for their food. Sheep should have daylight to eat by.

I would feed hay but twice a day, feeding not earlier than eight in the morning, and at two o'clock in the afternoon, the first half of the winter, and at seven and three o'clock the last half, giving grain about eleven o'clock. At each of these hours, the sheep will be looking for their feed, and if, for any cause, it be delayed one or two hours, they will be watching and restless; and if, for some cause, it is given one or two hours earlier than usual, for several days afterwards they will get ready for their feed at an early hour, and wait impatiently until it is given them. One and the same person should do all the feeding that an equal amount be given each time.

If we wish to secure the full benefit of their feed, and the greatest profit of their keep, we must avoid exposure to the changes of the weather. This can be done with warm sheds, well ventilated. Warmth is favorable to fattening—is equivalent to a certain amount of food. Science and practice agree on this point. I recollect reading, some time since, of a series of experiments in feeding, tried in Germany, which showed the following results: Sheep fed in warm, well ventilated sheds, required 22 pounds of food to 30 pounds for those fed without sheds; while the former gained 3 pounds, the latter gained but 1 pound, or in that ratio.

Food, though it must be supplied in abundance, ought not to be given to satiety. The digestive organs must be kept in a sound state. Herein lies the benefit of feeding roots; they help digestion, and keep up the appetite. Tranquillity is a requisite for good results. Sheep are easily frightened by everything that tends to annoy, like any other stock, such as a colt, or calves, which we sometimes see in the same yard, or even poultry, the presence of a dog, or too frequent intrusion of man, if any one but the keeper.

Comfort is another requisite. If too many are crowded into a given space, or into too small a yard for feeding, or the racks and troughs are inconvenient for taking their food, or if they are compelled to go through, or stand in mud or water to get their food or drink; these all operate unfavorably.

CLEANLINESS.—The sheep is naturally a clean animal, and they are very particular in regard to their food being clean. Feeding troughs should be placed where the sheep cannot jump over or step into them. A speck of dirt, if no larger than a pea, falling into the trough from a sheep's foot, or a flock of poultry getting into the trough and leaving their tracks or droppings, will prevent the sheep from eating their food.

In conclusion, I would say that I do not claim great profit can be made by feeding sheep, but, in many sections of Vermont, the hay crop is a profitable one, perhaps the most profittable of any produced; and some of this hay can be fed to produce mutton, and return to the feeder its cash value, and thus enable him to retain the manurial value of the hay to keep up the fertility of the land, instead of running it out by selling the hay before feeding it.

POULTRY KEEPING FOR FARMERS.

BY JOHN G. McKEEN, OF SOUTH ACWORTH, N. H.

There are but few farmers that realize the profit to be made in keeping poultry. Farmers can keep poultry cheaper than any other class, as they have a large range and a variety of food, most of which is grown upon the farm.

They do not require the amount of yards that are necessary in villages, nor such constant care. I have often made the assertion that nothing kept on the farm pays so large a percentage, for the capital invested, as poultry *rightly managed;* and I find but few that believe me. The profits depend more on the management than they do with cattle and sheep, for fowls will not bear neglect.

I shall confine myself to the management of hens for profit alone, and shall give what I consider the best method of growing chickens for the market, and obtaining the most eggs for the food consumed.

To begin with, we must have a suitable place to keep our fowls. No one would think of letting their cattle or hogs run loose over their farms, and it is as necessary to have a place to keep fowls as it is our cattle. If we build a house for our hens it need not cost such an unreasonable price as most hen houses do. A rough board building, made warm, is just as good as one costing hundreds of dollars.

W. H. Todd, of Ohio, one of our largest breeders of poultry, gives, in the *Poultry Nation*, his plan of building cheap poultry houses. He builds eight by sixteen feet; seven and a half feet high in front, four and one half feet at the back, with a shed roof. The sills are two by four inch scantling, halved together at the ends and spiked. These rest on three sleepers, six or eight inches high, running the whole length of the building, and leveled for the floor, which is cut and placed so as to fit just inside the sills. No posts are used. A couple of two by four inch plates, with rafters two by three; and then proceed to cover with upright boards, beginning at the corners, and the building is soon up. He either battens the cracks or lines with coal tar sheathing. He says a house of this size will accommodate forty fowls of the large breeds, if divided into two rooms, and can be built for from ten to twenty dollars, according to the price of lumber and labor. I have a small movable house, built something in the same style. Mine is five by ten feet, and the sills are four by six inches, two feet longer than the building, and shaped something like a sled runner. It can be drawn anywhere with one horse. I should have board floors if the house was located on dry ground, and no other is suitable for poultry keeping.

All poultry houses should be built in warm, sheltered places, and well lighted on the south side; but there is no need of having all the south side glass, as recommended by some writers. The houses must be built so as to be warm, and keep out all winds, and, at the same time, be well ven tilated at the highest point of the building. The doors and windows should be put in so as to be easily moved, and substitute latticed work in warm weather.

The inside arrangements should be simple, and everything movable. Boxes answer well for nests, and, for most breeds, should be placed on the floor, with a hole cut in one side for the hen to enter. The nests should be lower than the perches, or the hens will roost on the boxes. The floor should be covered several inches deep with dry earth or sand, and a good supply of dry leaves kept to scratch in. There should be a small platform for the water dish to stand on, raised several inches above the floor, so that the hens cannot fill the dish with dirt.

Many farmers have plenty of shed room that might be made over into a house for hens at small expense. One of the best places I ever saw to keep hens is that of J. H. Morrison, of Marlow, New Hampshire. He has a cellar under his barn. The wall on the north side is against a bank. The other three sides are boarded tightly, and lined with sheathing paper, and the east and south sides are well lighted. He has no floor, as the barn is built on very dry, gravelly soil; so the floor is a bed of fine gravel. His hens always look well, and do not get their combs frosted in the coldest weather.

Much depends on the hens kept. Every farmer should raise his own chickens, and they should be hatched as early as May 10th, or earlier if the season will allow it. The pullets ought to begin to lay by November 1st, and some breeds will lay earlier. They should be well fed with a variety of food, and get them to laying as soon as possible and keep them at it all winter. Eggs are always high in the winter. We must have early pullets or we do not get eggs at that season. It will be cheaper in the end for the farmer to get some pure breed; start with a trio, and get good built fowls of *good constitution.* Let the fancy points take care of themselves, and breed only for eggs and salable chickens. Any breeder has enough disqualified chickens that he will sell cheap, which are just as good blood as any in his flock. Another good way is to save your earliest and best shaped pullets, and get a cock of some pure breed and put with them. The chickens will almost invariably prove good layers. Either Brahmas, Cochins, Houdans, Hamburgs or Leghorns, crossed with common hens, will give good results in eggs and dressed poultry. My own preference for layers are the Hamburgs. They have justly been called "everlasting layers." They are small eaters, good winter layers, non-setters, and continue to lay well into the fall. They are not first-class market poultry, as they are small, and dress off rather blue.

The Cochins will lay the best in the winter, with cold quarters, of any breed I have ever kept. If kept in large numbers, they will be rather troublesome, on account of their propensity to set. If any breed but Hamburgs are kept, they must be fed stimulating food, and be made to lay all the eggs possible until about July; then all but those with young chickens should be sold alive. They will usually bring as much alive, at this time of year, as they will dressed in the fall, and it saves much feed.

Hamburgs will lay well nearly all summer, and will continue to lay well until three years old, while most breeds are the best the first year. If any of the non-setting breeds are kept, some other breed must be kept to raise the chickens. If any breed but Hamburgs is selected, the old stock must be replaced every year with early hatched pullets. This is very important, for we *must* have eggs in winter to make a good profit. Much depends upon the feed, both in quantity and quality. What we want is the greatest amount of meat and eggs for the food consumed.

There is no danger of over feeding, but much danger among farmers generally of not feeding enough. We can lay down no rule as to quantity. The safest guide is, give them as much as they will eat eagerly. Never give them more than they will eat up clean. The best plan is to feed twice a day. Give warm dough in the morning, and whole grain at night. It is well in very cold weather to give a light feed of something warm at noon. Scatter the whole grain among the leaves on the floor, at least an hour before the hens usually go to roost. Always give as much of a variety as possible. For general feed use shorts, fine feed, corn meal and barley meal. A good feed is corn and barley meal or shorts, equal parts. Feed more corn in cold weather, but not too much, as corn is not a good feed for eggs In warm weather let the feed consist largely of shorts with buckwheat or oats and barley. Buckwheat is the best grain I ever fed to stimulate the production of eggs. Wheat is also one of the best, but is generally too costly. It is necessary to have some animal food in the winter. This is best supplied by ground scraps, but be careful not to feed too much. I feed scraps every other day, mixed with the dough at the rate of a spoonful to each hen. They *must* have green food all the year round. Raw turnips, cut into thick slices and thrown on the floor, are the best of anything in the winter. Keep plenty of sand, gravel, oyster shells or cracked bones by the hens; and do not forget to give them plenty of fresh water. I use the "Douglas Mixture" nearly every day. It is made as follows: To one-half of a pound of sulphate of iron, dissolved in one gallon of water, add one ounce of sulphuric acid. Use a spoonful of this mixture to each pint of water that the dough is wet up with. I generally use a little cayenne pepper in cold weather. Last winter I tested a small package of "Imperial Egg Food," put up by L. H. Sherwood & Co., of Hartford, Connecticut, and it had a wonderful effect. It will keep the hens in good condition, and greatly increase the production of eggs; I shall use it again this winter.

The house must be kept clean, and should be whitewashed once a year. Wash the roosts with fish brine once a month to kill lice. A cheap and sure remedy is this: take a tin tube and a pair of old fashioned bellows; load the tube with tobacco; put in a small piece of red hot iron and the nozzle of the bellows, and blow the smoke into the feathers when the hens are on the roost. It is sure death to the lice, and does not injure the hens.

The manure must be saved; clear hen manure is fully equal, pound for pound, for most crops, to any phosphate I have ever used.

Most breeds of hens, if kept laying all winter, are ready to set when wanted. They should never be set in the same room with laying hens, as they are apt to get into a domestic row over the eggs, and most of them will be broken. It is best to have a warm room on purpose for setting hens. The best plan is to take a lot of old flour barrels, saw them in halves, and make a nest in each half, of moist earth covered with straw. That from an old straw bed is the best.

When you find a hen on her nest at night, let her stay on one or two nights, so as to be sure she means business. Then carefully move her in the night, and put her in one of the nests ready prepared in the setting room; give her a few old nest eggs, and cover the barrel so that she cannot get out. The next day let her off to eat, and put her back carefully. In a day or two she will go back of her own accord. Then give her from nine to thirteen eggs, according to the size of the hen and the weather. If it is cold nine are enough. See that the hen comes off every day to eat and drink. Let her stay off from ten to thirty minutes, if it is not too cold. Keep ashes in the room to wallow in, and sprinkle the nest with sulphur to kill lice. Sprinkle the eggs with water warmed to blood heat, two or three times the last ten days the hen is setting. Always feed whole grain to setting hens. Corn is the best, but give a change. I have had hens set seven weeks and come off in good condition.

Let the chickens stay in the nest the first twenty-four hours unless the hen is very uneasy. It is best to coop the hen, and let the chickens run until a few weeks old. Put the coop in a dry, sunny place. Do not have a floor to your coop unless the ground is wet and cold; but if a floor must be used, keep it covered with dry ashes or sand, and be *sure* and keep it clean.

Feed the chickens *often;* at first feed every two hours, from daylight to dark, and give only what will be eaten up clean at one time. I feed corn meal and shorts mixed, curd, boiled potatoes and, after they are a few weeks old, a few scraps, and the last feed at night of cracked corn. Give a little bone meal in their dough, say a spoonful to a pint of meal, once a day. Keep fresh water by them, and do not forget the "Douglas Mixture." And here let me remark that skimmed milk is one of the best feeds, or rather drinks, for either chickens or laying hens. The chickens must have a good range, and plenty ot grass. When old enough, let the hen out of the coop after the dew is off.

The chickens must have a chance to eat away from the grown hens. Make a rack of laths, or board sides and top will do just as well, and have the end laths run up and down, just far enough apart so that old hens cannot get through; two feet is high enough. The size of the rack can vary with the number of chickens raised. Keep cracked corn by them, and feed four times a day with dough, after the chickens are five weeks old. The cockerels should be sold for broilers when large enough, if possible. They should be sold early at any rate, as they bring a good price, and it saves feed. If kept until fall, the cockerels should be separated from the pullets when about twelve weeks old, the age depending somewhat on the breed. Keep over only the best pullets. Many farmers sell the largest and earliest because they bring more.

Any number of fowls may be kept, always remembering that twenty are enough to be kept in one flock In localities where hawks and foxes do not trouble, small, movable houses, such as I have described, can be scattered over the farm. Use no yards, but give the fowls their liberty, and they will thrive and pay a good profit.

Hens do well in an orchard, and will almost pay for their keeping by destroying insects. I know of an orchard of five acres, in Hancock, New Hampshire, that bears very heavy crops, and the fruit is remarkably fair. The owner says it is because he keeps hens in the orchard. He has small, cheap houses, and keeps twenty hens in each flock. I think he has five houses in this orchard. We must always remember that the nearer we imitate nature in the care of our fowls, the better they will pay. We must use system. Be regular in feeding, and neither over feed nor starve them, but give them enough every day. As I have said before, fowls will not bear neglect. They require constant care. It will not do to give them a large feed in the morning, and forget them at night. I have not had much experience with diseases. I have never had a case of roup, cholera, or any of our prevalent diseases. If fowls are well cared for—not crowded into filthy houses—and the "Douglas Mixture" is freely used, disease will be almost unknown.

The profits will vary, depending somewhat upon the location, breeds and care. To get the most profit a good market is requisite. Good fresh eggs will always sell in large villages, and when a farmer gets his reputation established, he can always sell to hotels and private families much above the market price. It costs about the price of a bushel of corn to keep a hen. If the hens have suitable care they will pay from one to two dollars profit each, counting the manure to pay for the care. Some of my neighbors clear more than two dollars from each hen.

Farmers should use more eggs and chickens at home. They are luxuries in too many families, that cannot be afforded except on extra occasions. I believe in more chickens and less pork, especially in warm weather. Every farmer should raise all he needs for home use at least. It is not best for a beginner to go in too largely. Let him begin with a few, and after he has had experience enlarge his flock.

Take the papers, by all means, and plenty of them. A good work on poultry and one or more poultry papers are absolutely necessary. It always pays to profit by the experience of others.

Many farmers do not find time to care for their fowls. It would be a good idea for such men, and, in fact, all others, to give their boys a few good hens, fix a place to keep them in, and let them have the profits, after paying, in eggs and chickens, for the keeping. Teach them to keep an account with their hens, so that they can tell just what it costs to keep them and how many eggs they lay. You will find that they will take a wonderful interest in "hen farming," and more of them will be willing to stay on the farm. I believe boys have rights that we are bound to respect.

I do not recommend the keeping of poultry to the exclusion of other farm stock, but I believe in making the most of everything kept on the farm. If we give our poultry the same constant care, and take as much pains to improve our breeding stock as we do our cattle and sheep, we shall find that hens, although little things, give large profits, and will wonderfully help to make our year's profit on the right side.

If farmers would give poultry keeping a fair trial, they would wonder at their neglecting such a source of income for so many years. You cannot cheat your hens. Deal fairly with them and they will do the same by you, and you will have no reason to sing the usual song of farmers: "Hens don't pay."

BEE KEEPING.

BY DR. F. BOND, OF CORNWALL.

In presenting a paper on the subject of bee keeping before this Board, its author felt constrained, in opening, to defend himself against the charge of being in small business.

I trust there is, on this occasion, no such necessity, as the claims of bee keeping are being more generally conceded, and especially as the subject has been discussed in this place, before a former meeting of this Board, by the most successful apiarian in Vermont, and I think I could most truthfully say, in New England.

In assigning me the honeyed subject of this meeting, I am gratified to have it in its broadness as bee keeping, and having such liberty, I propose to improve it in the effort to awaken some degree of interest on the part of those who have hitherto given little or no thought to this sadly neglected interest.

It has become a standing query among New England farmers: How, with our feeble resources, are we to sustain ourselves against the powerful competition of the West? The West, including California, has taken quiet and undisputed possession of the honey markets of the East, so that, as you are doubtless aware, the larger markets of this valley are supplied with California honey, and this, too, in face of the fact that the honey resources of Vermont are not made available in the proportion of one to one thousand.

A lengthy paper, read before this Board a year or two ago, upon the sugar interest of Vermont, the second maple sugar State of the Union, reports a year in the past, when Vermont produced about nine and three-fourths millions of pounds of maple sugar, or about one hundred pounds per square mile, which is really something to be proud of. The State of New York boasts of producing 25,000 pounds of honey from a tract of twenty-five square miles, and the territory not fully stocked. We are told, on the authority of the editress of the *Anerican Bee Journal*, — high authority on all matters of bees and honey,—that the province of Attica, in Greece, embracing forty-five square miles, kept 20,000 hives, which averaged thirty pounds per hive, or 13,320 pounds per square mile, for the whole province; and, on the same authority that the province of East Friesland, lying contiguous to the North Sea, in Holland, and embracing 1,200 square miles, maintained, for a period of twenty years, 2,000 colonies of bees per square mile; the amount of yield not given, but at the moderate estimate of twenty-five pounds per hive, we have the enormous amount of 50,000 pounds per square mile, or nine hundred tons for a township of six miles square, which would produce, at the unheard-of price of ten cents per pound, $180,000 for a territory of the size of one of our townships.

Do you ask what those Dutchmen do with so much honey? They eat what they want and export the balance, hundreds of thousands of dollars' worth of it coming to the United States in a single year, as our statistics of commerce will prove; and the West Indies, Mexico, and even Africa, join in to eke out the supply; all of which is like carrying coals to Newcastle, for probably no country on the globe has the resources for supplying her people so abundantly with honey as ours. In spite of all these facts, no people are probably worse provided than ours, not one in twenty of whom taste honey from one year's end to another. We could vie with Switzerland, which boasts her honey against the world, and sets it before the traveller wherever he eats, in public or private, if we would conserve the Heaven distilled nectar that God diffuses over all the surface of our broad land, almost as universal as the air we breathe. But the fact is patent that we do not do it. Well, what can be done about it?

The discoveries made within a few years of the nature and proper management of bees, has made the practical solution of this question comparatively easy. Movable comb hives remove most of the difficulties of old time bee keeping. Instead of destroying the bees for their honey, as is still done in some parts, the colony can be perpetuated indefinitely, and so directed in their increase and labor, as to render results not only comparatively certain, but *immense*, as compared with the products of former times.

The theory and practice of bee keeping upon modern principles is so fully taught in books and periodicals of so easy access, that whoever will may not lack the means of knowledge, and it hardly seems proper, in a meeting like this, to inflict upon those who have no aspirations after honey in "the natural way," the details and minutiæ of the process. I shall therefore pass rapidly to a close, simply naming some of the prominent features of the business necessary to success.

First of all, we must have good bees in a good hive. By good bees I do not mean any particular strain, but vigorous, industrious and amiably disposed bees of whatever color and name. Experienced bee keepers, by general consent, give the yellow or Italian bees the preference, but there is no doubt that good black bees are preferable to poor Italians, and any judicious apiarian will find occasion to encourage and extend some families, and change others, with reference to all the conditions named above. I think there is even more difference in the actual value in different colonies of bees, aside from their number, than in the different cows in our dairies.

By good hives, I do not mean hives of any particular name, but such as are adapted to the location intended, the skill of the operator and his special purpose—whether of obtaining fluid surplus or comb surplus in small or large boxes. The next object is to get the good hives full of the good bees, and, so far as practicable, to keep them in that condition. To this end a vigorous and prolific queen or mother bee is indispensable, with plenty of room for brood; also, either supplies in plenty on hand or a good range. A nice point is to keep just so much comb free from honey as is needful for brood. Valuable stocks are often crippled, if not ruined, when honey is flush, by allowing the workers to fill up the brood combs, thus preventing the amount of brood necessary to repair waste, for it must be borne in mind that the waste of bees during the active season is very great. The remedy in this case is either the extractor or the exchange of full combs for empty ones, placing them in the midst of the brood nest. I think it best done at evening, thus allowing the queen more time to deposit eggs in it.

In establishing new swarms, whether natural or artificial, it is of great importance to give the new swarm as much comb as possible, that brood rearing and honey gathering may go on vigorously from the start. If the swarm is started with combs at the commencement of the honey season, it will often make the difference between forty and fifty pounds, and even more, of surplus and none at all. If one has no combs, (no comb should be rejected on account of age or color,) I would recommend to others what I intend to use myself, the newly devised comb foundations, for, though much inferior to natural combs, they must forward the operations of the hives much and aid greatly in securing straight combs. Attention to securing straight combs and confining drone cells to very small space will be richly compensated in both convenience and profit.

Surplus honey should be removed from the hive as fast as the boxes are filled, as the combs become dingy by the bees passing over them—and, too, swarms that have a large amount of honey in the hive will not work when honey comes in tardily like those that are a little short.

When the frost has closed the honey season, the condition of all swarms should be definitely ascertained, and those that have more than is needed share of their abundance with those that are in danger of deficiency.

THE RELATION OF BEES TO FRUIT CULTURE.

BY JAMES E. CRANE, OF BRIDPORT.

I have chosen as the subject of this essay, "The Relation of Bees to Fruit Culture" and general agriculture, and shall attempt to explain the part these insects take in the fertilization of flowers and their relations to certain fruits; and, if I may throw some light upon the minds of those persons, otherwise well informed, who regard the presence of honey bees as injurious to their crops of fruit or fields of clover, lest they should visit their flowers and rifle their sweets, I shall feel repaid for this effort.

This belief of many tillers of the soil, that injury is done by the bees in extracting the sweets from flowers, is no new thing, but has cropped out now and then during the last five hundred years, producing as much consternation among the ignorant as the sight of a comet or an eclipse of the sun. And, not unfrequently, has this unreasonable prejudice been so rabid and wide-spread in its demonstrations as to constrain the almost total abandonment of bee culture where fruit raising bore sway. Nor has this prejudice died out with the centuries, but is, to-day, entertained by large numbers in our very midst, and we are scarcely surprised when we hear of persons imputing the loss of their fruit crop to the bees. Some time since, a good woman came to her neighbor, who kept a dozen colonies of bees, and asked him to shut up his hives as his bees were taking all the sweet out of her flowers and it made her currants sour. Within the past year, even, a somewhat celebrated naturalist in our own country has advised the wholesale destruction of bees by feeding them with sweets mingled with poison. It is not the object of this paper to discuss the morality of such advice or its effects upon good neighborhood, but rather to show that the interests of the fruit grower and honey producer and general farmer are, and must ever be, mutual.

To the superficial student of nature, its processes often seem contradictory and unaccountable, while, to the more careful observer, all is order and harmony.

Few are the persons who do not know, at least theoretically, the injurious effects of what is called in and in breeding among animals. The same is true, to a great extent, among birds and insects, and even plants are subject to the same law. In order that seed may be produced, it is necessary that the grains of pollen from the stamens should come in contact with the stigma of the flower. In very many specimens of plants the stamens and pistils are found in the same flower, but they are not unfrequently placed in such a position that it is next to impossible for the dust from the stamens to drop upon the stigma of the same flower; and, where it can, it has been shown by Darwin, Gray and other eminent botanists that such dust has less fructifying power than that from the blossoms of other plants of the same species. The flowers of some species mature their stamens first, and shed their dust before the stigma of the same flower is sufficiently advanced to receive it, while others produce blossoms in which the pistil is first developed, and the process of fecundation is complete before the stamens drop their vital pollen. In some plants we find the stamens and pistils separated from each other and located some distance apart, yet upon the same plant; while in others we find one individual producing stamens alone, and another producing pistils.

The question now very naturally arises, How can the proper fertilization of plants be accomplished, or how shall this fructifying dust pass from flower to flower? Are not plants imperfectly formed to be, thus of themselves, incapable of the production of seed, and so perpetuating their respective species?

I answer, not at all. Nature is a unit. True we see the necessity of some agent to assist plants in carrying this life-giving dust from one to another, and we also see a great variety of bees and other insects ready and eager for the work, for the sake of the food the plant may give them.

Let us for one moment examine the common honey bee. We find it of the proper size and shape to visit the larger portion of the flowers of the most valuable plants in this latitude. The color and fragrance of the flowers attract them. The flow of honey is protracted for several days, thus securing continued visits. We find the body of the bee covered with hairs, like a brush, with which to secure and hold the pollen as it flies from flower to flower. The nectar produced by the flower proves just the food best adapted to its wants, and in the superabundance of pollen, when mingled with honey and water and partially digested by nursing bees, just the food best adapted to the wants of their young.

Further, the instincts of the bee teach it, when on a foraging expedition, to visit only one species of plants, as is proved by the pellets of pollen on its legs as it enters the hive, and also to lay by in seasons of abundance for that season when no flowers are found, that its existence may be perpetuated and repay man for its care; and, lest some less industrious but stronger creature should appropriate their sweets, they are provided with a weapon, tiny, but powerful, to defend their stores.

The plant is without power to carry the fertilizing dust from one to another; the bees have this power, and the plant repays them for their labor by furnishing them with all their food. The great object for which the bees were formed in the economy of nature, it seems to me, was to act as agents in carrying this fecundating powder from one plant to another, and this nectar and superabundance of pollen to supply them with food. Let us here introduce a few facts to corroborate these statements. In 1774, Count Anthony, in Bavaria, President of the Academy of Science at Munich, proved by official family records that, a century earlier, when bees were kept by every tenant on the estate, fruit was abundant, whereas then, when only seven kept bees and none of these kept more than three colonies, fruit was scarcer than ever among his tenantry. Some years ago, a wealthy lady in Germany established a green-house at considerable cost, and stocked it with a great variety of native and exotic fruit trees, expecting abundant crops in due time. As time passed on her trees produced a great abundance of flowers, with only a little fruit. Various plans were devised and adopted to bring the trees into bearing, but without success, until it was suggested that the blossoms needed fertilization, and that by means of bees the work could be accomplished. A hive of bees was introduced the next season. The remedy was effectual. There was no longer any difficulty in producing abundant crops of fruit. The bees distributed the pollen, and the setting of the fruit followed naturally.

Similar statements come to us in regard to the orchard house of Stephen Morris, Esq., near Philadelphia, where peaches are grown by the bushel in fifteen inch pots and eighteen inch tubs; the gardener attributing much of his success to the agency of bees in fertilizing the blossoms. He places a hive in the house as soon as the flowers begin to open, and it is kept there until the petals fall.

A large fruit grower says that his cherries are a very uncertain crop, a cold northwest storm frequently prevailing when his trees are in blossom. He had noticed, however, that if the sun shone only a couple of hours the bees secured him a crop.

We have the authority of Darwin for stating that twenty heads of white clover, unprotected from insects, produced 2,290 seeds, while twenty other heads, that were protected, produced not one. Also, twenty heads of red clover, unprotected, produced 2,700 seeds. The same number, protected, produced not a single seed. Indeed, he believes that it is highly probable that the last named clover would become extinct but for the humble-bees.

And may we not find here a reason, in part, at least, why the second crop of red clover seeds so much better than the first, as in later summer humble-bees are much more abundant, while the corolla of the flowers of the second crop is much shorter, thereby giving other bees and insects an opportunity to work on them. Somewhere I have seen the statement that the clover seed introduced into New Zealand produced abundant crops of forage but no seed, until the honey bee was introduced, when abundant crops of seed followed. As the name of the clover was not given, I suppose it to have been the white clover. More recently, I notice that the New Zealand government has sent special agents to England for the purpose of collecting a quantity of small birds and a colony of humble-bees for introduction into that country, the humble-bees for the purpose of fertilizing the blossoms of the red clover, that they may produce their own seed. Quite recently, Russia has been introducing this race of bees into her vast domains, believing it cheaper than importing clover seed.

I believe that it has been quite clearly proved that the white clover is indigenous to New England, yet I think it is certain that its advance westward across the continent has been simultaneous with that of the honey bee; the red man having long since considered the appearance of this plant and the "white man's fly" as sure tokens of advancing civilization.

Says James M. Marvin, of St. Charles, Ill.: "I have grown seventy-five bushels of currants, twenty-five of goose-berries, and apples, pears, cherries, and all kinds of fruit that can be grown here, in abundance; and the same year had six hundred and fifty stocks of bees within working distance of the fruit garden." * * * * "The red clover yielded surplus honey for boxes the first time for twenty years, and also the largest crop of seed. The melilot clover yielded the largest crop of seed and also of honey for many years. One year I saw the white clover in flower for fifteen days, but no bees were at work on it during that time, and no seed was formed. A change in the atmosphere gave a yield of honey, and in a few days the flowerets turned down with the growth and weight of seed, of which each pod contained many." Again he says, "I have seen buckwheat that had been sown in the spring and also such as was sown in the latter part of summer in flower for thirty days at a time and no honey gathered or seed set, yet a change of atmosphere gave a yield of honey and grain in proportion." I might add that I have observed similar facts myself.

It would seem as though enough had been said upon the value, I might say the necessity, of bees as agents in the process of fructification, but, since writing the preceding, I have received from a friend the following paragraphs from a French author, which he has kindly translated for my use. They are so much to the point, tending also to confirm the foregoing statements, that I will insert them here.

He says: "Without wishing to attribute to insects more power than they really exercise in the great harmonies of nature, we must recur once more to the importance of their *role* in indirect fecundation. It is evident that they often fertilize flowers by pollen of the same species, but by grains of pollen taken from different individuals, and that there arise in this way progeny which, without this intermediation, would have sprung from the union of near relations. (Too close inter-breeding, even among plants, is often detrimental to the offspring.) The importance, so well established, of a hive of bees in proximity to an orchard or garden supports this opinion of the active part taken by insects in forming indirect fertilization. One will not be astonished at this importance if he recollects the curious conclusions which Herbert, of Geneva, has drawn from his numerous observations. According to him, "the bees of a single hive will fly over a circle whose radius is two and one-half miles." I have known them to fly twice that distance. "Giving to a hive an average population of 12,000 inhabitants, and attributing to each bee four journeys per day, we shall obtain 48,000 chances multiplied by the number of flowers which each bee visits on each trip. Allowing ten flowers and 480,000 visits (to flowers), which will be augmented in an enormous proportion if another hive is situated near the domain to be explored, (* * * and) we shall be forced to believe that each (flower) has had many chances to receive the fertilizing dust from another flower."

"The transport of pollen by insects is a fact perfectly evinced. There are plants that, without them, would remain constantly infertile; and, if several species of our hot and green-house plants remain sterile, it is often because we have not imported along with them the insects which live among their flowers, which enter their corollas, and which, moving their wings, exchange with them the benefits of which nature alone knows the value and has directed the reciprocity."

"Is not the presence of honey and its secretion at the time of the full bloom of the flower among the means and mysteries which the Author of nature has put in operation to assure his immutable designs? Does not the honey attract wandering tribes of buzzing insects, whose bodies, armed with a thousand brushes, scatter the pollen over all parts of the flower and thus accomplish, while they are gathering booty on their own account, a great work of reproduction."

"They (the insects) are the veritable mediators in the marriage of flowers."

"What would become of the diœcious plants whose pollen, like that of the willows, cannot be borne on the wind, if the legions of insects which come forth with the springtime flowers did not lend the aid of their wings and bustling activity?"

Does extriacting the honey from the blossom injure the quality of the fruit or impair the value of forage plants? I believe there are many that would answer yes. Let us first inquire a little into the nature of this nectar. The learned tell us that it is a liquid sweet composed largely of two substances, very similar in character to what is known as grape and cane sugar. It also contains a little gum, wax, an aromatic principle and, according to some authors, a trace of what appears to be acetic acid. Yet we find that no two plants produce precisely the same quality of honey. There are but few persons who do not know the difference between clover and buckwheat honey. Indeed, we find as many kinds of honey as there are plants to produce it, all varying according to the nature of the plants. Some kinds are pure white, or clear like water; others tinted pink, or green, or yellow; others of a rich golden hue, while some are a wine color or a dark brown. Some varieties granulate very soon after being gathered, while others remain liquid for a long time. A still greater difference is found in the flower aroma and the quality of honey, which seem always to partake more or less of the nature of the plant that produces it.

Nearly all honey undergoes some change after being gathered by the bees before it is sealed in the hive—a process that is called by apiarians "ripening." Our clovers produce a pure, rich flavored honey; the basswood a much higher flavored honey, but much more liable to sicken those who use it; that from our fruit trees is all choice, while that from the raspberry is very superior; that from the dandelion, like the blossoms, is yellow in color and has a rank flavor; that from the onion partakes too much of the nature and fragrance of the bulb to be a favorite until well ripened in the hive; while that from the thoroughwort proves altogether too bitter to be of any commercial value. Orange blossoms produce a delicious honey. Nearly all leguminous plants produce honey of an excellent quality. The various species of golden rod, wild asters, maples, heart's-ease and many other plants produce honey in considerable quantities, of whose qualities I have not space to speak. Some kinds of plants produce honey that is poisonous, such as the mountain laurel and, I believe, the tobacco plant also. For commercial purposes the mint family produces the finest honey of all, and from the wild sage of Southern California, a plant very nearly allied to our domestic sage, is produced large quantities of honey, rivaling any other produced in this or, I believe, any other country, surpassing even the justly celebrated honey of ancient Hymettus, which was produced largely, so far as I am able to learn, from the heath family of plants.

I will not dwell longer upon the differences found in honey from different species of plants. Sufficient has been said to show that it varies with the nature of the plant that produces it. And I believe that this nectar, usually called a secretion, is an excretion instead—a something that the plant has no further use for and which, in the economy of nature, is excreted during the time of bloom by the flower for the purpose of attracting insects and thus securing healthful fecundation. In some plants we find the blossoms insufficient for ridding the plant of this superfluous nectar, which seems to be produced by certain atmospheric conditions as well as certain conditions of the soil, and the leaves of the plant take on the extra function of excreting it, and then it is called "honey dew." So abundant is this excretion in some countries that people gather it by setting vessels under the trees and shaking them.

This must not be confounded with the saccharine substance often excreted by the aphides upon the leaves, and called by many "honey dew."

Any person who has examined trees where this excretion from the leaves is found and seen the substance thrown off by these insects will readily perceive the difference. As before mentioned, the flow of honey is usually continued from day to day after the opening of the flower until the petals wither and fall. This flow, however, depends very largely upon the state of the atmosphere. It is not unfrequent that flowers may be in bloom several days before the weather is such as to produce any honey at all, as was the case the past season for more than a week after the opening of white clover. There is a change in the atmosphere (we cannot tell always what it is,) and honey flows into the nectary of the flower rapidly. Again, it is excreted only during the warmest part of the day, and again only morning and evening; and sometimes I have noticed only in the forenoon and at other times only in the latter part of the day. At one hour of the day honey may be abundant, and the next literally none. Only in very rare cases does it accumulate in the flower.

Now, if, as I have shown, this substance is an excretion, the plant certainly loses nothing by its abstraction; besides it is evident that if this nectar was not taken by insects it could not be appropriated by the plant, as it would be quickly dried by the atmosphere or washed away by the rains. But, even if it could be retained by the plant, the amount on each flower is, in most cases, too infinitesimally small to affect the flavor even of our fruits, much less the nutritive value of our forage plants.

While a field of white or alsike clover is in bloom it is usually swarming and musical with honey bees, but only a few dozen "droning humbles" will be found on an acre of red, though in full bloom it is redolent with sweet flavors. If, then, the retention of the saccharine element so essentially affects the value of forage as one of its milk-producing constituents, that the value of cream and butter is affected by what the bees carry off, how comes it that the milk product of the red clover is so greatly inferior, both in quality and in quantity, to that of the incessantly despoiled white or alsike?

Any one at all observing knows that the quality of fruit is greatly improved by the thriftiness of the tree and a free circulation of air through its branches, and above all exposure to sunlight. Even the sunny side of an apple is much higher flavored than the other side. Can it be said that the bee has left the honey on one side and taken it from the other, thus injuring the quality?

With these observations I will leave this part of my subject and pass to another, which has agitated the minds of both fruit growers and bee keepers to a considerable extent, during the past year or two, throughout the whole country.

Do bees injure such delicate fruits as grapes, pears, peaches, etc., by cutting through the skins and sucking the sweet juices of the fruit? I am well aware that it will not be a difficult matter to find very many to assert that they do. The most casual observer knows that they are very fond of these sweet juices, and will take them very quickly when the fruit is already broken open, but do the bees cut through the fruit themselves?—that is the question.

Thus far in our investigations we have found the bee only the friend of man, and it would seem at least a little contradictory if, when they have been so instrumental in the growth of fruit, they should now prove its worst enemy.

From the structure of the mouth of the bee it would appear poorly adapted for cutting into fruits. But what are the facts in the case? I find, in looking over the testimony in favor of the bees, cutting the skins of delicate fruits and thus doing great harm, that the evidence is mostly quite indefinite. The bees do the mischief because they do, say these persons who regard the honey bees as their enemies, or because the fruit is covered with them, or because that in some Report of Agriculture some one says they do, or, perchance, because some bee keeper admits that the bee may do such things. Such testimony, it seems to me, would not prove very valuable in any of our courts of justice. I feel that I can not do better than to give the positive evidence of a very few persons that bees never molest perfect fruit, which seems of much more weight than a large number of mere opinions to the contrary.

Says H. O. Kruschke, of Greene, Wisconsin, in the *New York Tribune* of December 31st, 1873: "I took a bunch of Delaware grapes (the tenderest I could find,) and put them on the hive, directly over the bees, and watched the proceedings, but not a single berry was punctured. Then I broke a few of the berries, upon which they immediately went to work and sucked them dry—thus showing that something besides the bees must open the grapes or any other fruit before the bees can touch it."

The experience of J. W. Bayard, of Athens, Ohio, is so much to the point that I am tempted to give it also. He says: "Over twenty years I have cultivated both bees and fruit, consequently my affections are about equally divided between the two. My colonies, say sixty to eighty in number, are located under apple, peach, pear, quince, cherry, grape and plum trees, where contact occurs necessarily every season. Being a person of leisure, my opportunities have been good to closely inspect this question. In years departed I have witnessed my bees swarming by thousands upon my trellises, apparently threatening the entire destruction of my grape crop, to say nothing of my pears and peaches. My neighbors too give their unimpeachable testimony to the same state of facts among themselves. Surely this ought to be sufficient to convict every bee in the land and, as the lawyers say, we might here rest the case. Now, I have summed up all I care about on this side of the question, and am free to say there is not any evidence touching the vital point at issue.

"Who cares about what bees eat in general? All winged insects live on something. Every bare-footed boy in the land can testify to bees, extracting the juice from pomace lying around a cider mill, peaches, pears or grapes that have been maimed, crushed, eaten into or broken open by some other agency; but not one living soul in all the parties to this question have seen, with the physical eye, the honey bee, at any time or under any circumstances, pounce upon a bunch of grapes or other fruit untouched by other insects, perfect in all respects, and, with its mandibles, eat through the skin or rind and open up its contents to a free bouquet!

"The season of 1872 visited a fearful drouth on this portion of Ohio, and the bees and birds alike were hard up for provender and made sad havoc with our grapes. Some citizens counted their loss as high as twenty bushels, and vigorously pressed the village council to expel the bees, by ordinance, beyond the corporation limits. Acting on the spur of the moment they actually passed an ordinance to its second reading (repeating the Wenham farce,) imposing a heavy penalty for keeping bees within said limits.

"In the meantime I had not been idle, but, applying tests to satisfy the people of their error, I invited them to come upon my grounds, and see for themselves the robins, red-birds and orioles that lay dead under my vines and fruit trees, with grape seeds in their stomachs and mouths, as I had often shot them in the act of biting open the grapes as they hung upon the vines. Our bees were undergoing a test also. Three hives had as many bunches of ripe Concord grapes tacked to their fronts, that passing out and in contact was unavoidable. On the fifth day they remained untouched, save the bees hunting through and over them to find an open berry. Then I opened with my knife say a quarter of the berries on each bunch and, true to their instincts, they began taking up the juice before I had completed the job. In about forty-eight hours they had taken up all the juice and pulp I had offered them, and, four days later, when I removed the bunches, not a single berry had they opened, but were busily inspecting those that remained, doubtless waiting for some stronger power to lead in the business.

"The bald hornets, both black and yellow, are experts in cutting into peaches, pears, grapes, etc. In handling fruits, I have seen them cut through the rind of ripe and tender peaches with great facility, thus leading the way for more feeble insects to follow and take up their contents, and therein lies the great mistake with the hundreds of complainants. Birds and hornets are few, indeed, when compared with bees, and, while they glide along, opening up and inviting to the feast, are rarely noticed. The honest bees tarry, to appropriate for the supply of their homes, and are seen by the million and are condemned as thieves and burglars.

"The most persistent and clamorous of our citizens, who had threatened bee men with the law and their bees with strychnine, were the first to come forward and thank me for what I had placed before their eyes as the true solution of the whole question, for all who took the trouble accomplished exactly the same results by the same means that I had used."

Now, this is no new question, but one that has engaged the attention of fruit growers and bee keepers in Europe for very many years, where the grapes are much thinner skinned and more delicate even than our own.

Says Mr. Charles Dadant, of Hamilton, Illinois, who, by the way, is a native of France: "I have cultivated bees in a part of France where grapes are the main crop, near the hills of Burgundy, celebrated for the wine produced by the culture of the Sugared Pineau, a grape richer in sugar than all the American kinds. * * * * There has been considerable discussion between the wine growers and bee keepers of the above named district, and it is very well established that the bees are unable to cut the skins of the grapes. In order to ascertain the fact, the most juicy and sugared grapes, pears, sweet cherries, plums, apricots, etc., were put inside the hives. Never have the bees attacked them if they were not previously scratched. The experiment was repeatedly made. It was discovered also that the first cutting was made by a kind of wasp or by birds, or caused by rain falling when the fruit was ripe. In Italy the same experiments have led to the same results."

From the foregoing we find the bee to be the friend and only the friend of man. Let us, then, carefully cultivate their acquaintance and supply their simple wants, and we shall not only find much to admire in them but shall receive from them treasures of the most delicious nectar, as well as their much needed assistance in fertilizing the flowers of our most valuable plants.

FERTILIZTAION.

IS SHELL MARL A FERTILIZER?

BY HENRY MILES, OF MONKTON.

To assist us in this inquiry we have a few important points well established, viz.:

No soil is productive which does not contain a considerable proportion of carbonate of lime.

A productive soil may be reduced to barrenness by abstracting its lime by incessant cropping.

An unproductive soil may, in many cases, be rendered productive by the addition of lime.

We have a large amount of carbonate of lime in the several deposits of shell marl distributed over the State, and this costs nothing but the labor of digging and drawing. It is not an "Emma mine," that promises much and yields but little.

Many working farmers adhere to the old maxim: "Early rising and hard work are the chief things in the improvement of agriculture." We do not reject this as wholly untrue, neither can we insist that hard work injudiciously applied will produce the desired improvement. The intelligent farmer knows that there is no *real* conflict between science and labor. The belief that those two agents may and *should work together*, has laid the foundation of every agricultural college in the land, and that this belief is taking a deeper hold on the minds of working farmers, we have renewed evidence from year to year, and rejoice at it.

We *know* that there is a wide difference between the fertility of *new* and of *worn out* farms; we may entertain a full conviction of this and yet be unable to define exactly the ingredient that is needed to restore the impoverished soil to its primitive fertility. At this juncture, men who have paid more exact attention to the subject, and have a chemical apparatus at their disposal, offer their suggestions; several valuable papers on this subject have been read before the Board, and the most of them have spoken highly of *lime* in some form, as an important agent in restoring fertility. On this subject Professor Peter Collier says: * * "Mineral fertilizers are applied to the soil, and often with most beneficial results, though often the theory of their action is a matter of conjecture. Of these lime and plaster, or gypsum (a compound of sulphuric acid and lime), may be mentioned." (Page 432, first report.) The question proposed by E. R. Towle, Esq. (page 131), may have drawn from Professor Collier the above reply.

On page 427 Professor Collier also says: "These analyses show further, that of the sixty-five elements existing in the earth, plants select for their food but a small number;" * * * and on page 432: "Lime, in some form, occupies a prominent position among needful *earths;* bringing this in contact with carbonic acid we have *carbonate of lime.*" And thus, also, we happily find Professor Collier indirectly expresses his agreement with Sir Humphrey Davy, of England, Professor James F. W. Johnson, M. A., F. R. S. L. & E., of Scotland, Edward Hitchcock, LL. D., and his associates, in their Report on the Geology of Vermont, and other writers on agricultural chemistry.

The statement of Dr. Hitchcock is as follows: "First and most important of all, we think we have discovered the reason why Vermont so excels all the other New England States in the agricultural capabilities of her soil. It is the existence, in almost all of her rocks, of lime in such a state that natural processes bring it out in just about the quantity needed by vegetation. This is the case in many parts of the State where the inhabitants hardly suspect the existence of lime, and those parts of the State most fertile are just the places where lime is most abundant and decomposable. This is a treasure which Providence has hidden in the earth, and provided for its elimination at the right time and quantity, and it is of far more value, in my estimation, than all the other subterranean wealth of the State." (Page 15, Preliminary Report.)

The testimony of Professor A. D. Hager is in the same line; he says: "Were the soil deprived of lime entirely, large tracts of country, now supporting luxuriant vegetation, would become desolate and barren wastes." (Page 747.)

As a general rule, we may gladly accept the above statements, as we bear in mind the fact that repeated cropping and carrying off the products of our farms, without returning their equivalent in some form, does absolutely diminish their fertility. Every cultivator of the soil can point to more than one farm on which this decreasing fertility is perceptible, although not wholly deprived of manure. Nearness to a railroad and a good market for hay puts temptation before some men that is not easily resisted. They little suspect that in every ton of clover hay they carry off there are fifty pounds of lime, and other varieties of hay contain more or less according to the kind. A crop of oats also carries off a large percentage of lime.

It is granted, say some, that the fertility of some farms is decreasing; how can it be restored? Copious answers to this question appear in the published reports of the Board. Among them we find Professor S. W. Johnson, of New Haven, Connecticut, who says: "The reason of the truth of the old saying, that 'if you can start clover you can grow anything else,' is apparent. Its great value as a fertilizer is accounted for in the vigor with which it appropriates food, both from the soil and from the atmosphere. It brings up, by its deep growing roots, the mineral wealth of the subsoil, and leaves it in a place and condition to be easily reached by the roots of succeeding crops." And Professor Johnson refers to a table which shows that the weight of the roots and stubble of clover is about three times that of oats or wheat; showing two hundred and forty-six pounds of lime in the ash of clover, against eighty-one pounds in oats and seventy-two pounds in wheat, on one acre of land. This method of bringing the fertilizing agent from the subsoil all farmers are familiar with, and the use of the subsoil plow points in the same direction.

But what is the chief mineral fertilizer that is brought within the reach of the roots of other crops? It is *carbonate of lime*, seventy-five per cent. of which is found in shell mal; and of this 300,000 cords, according to the estimate of Professor C. B. Adams, lie unused in Monkton Pond.

By referring to pages 697 and 698 of the Report on Geology, it will be observed that in the analyses of the several samples of shell marl from different parts of the State, the proportion of carbonate of lime runs from 89 to 72.9 per cent.; water and vegetable matter from 5.5 to 13.5 per cent. As this marl absorbs a large quantity of water and parts with it very slowly, two samples from the same deposit may exhibit a considerable difference on this point, resulting, of course, from the various means used for removing the water. The sample that came under the notice of Prof. Adams was probably the one he obtained by using this, an instrument, a sort of probe attached to the end of a long pole, which was thrust down through the upper stratum, without filling, and drawn from a much lower one, that is more compact. The sample before you was procured from Monkton Pond by the same instrument, attached to the end of a pole not more than seven feet long. This sample was procured about the 1st of December, by cutting through one foot of ice, and dropping the probe through two feet of weeds in water, and three feet of marl; from the lowest stratum that I could reach this pint cup was filled. Its contents weighed twenty-one ounces; after standing two weeks in a favorable place for drying its contents weighed seven ounces—losing two-thirds of its volume and weight. It presents now the appearance and condition which it reaches after exposure to the sun and air during several weeks of summer.

One or two years before Professor Adams examined this deposit, my neighbors, Roderick Baldwin and the late Medad Hurlburt, and myself, drew several sleigh loads of this marl and spread it on meadow land that was easily reached, as an experiment, and without taking notice of the many other sources of lime from which the soil could draw its supplies; the result was like the "going-it-blind" application of gypsum. The soil on which it was spread already contained its measure of lime, more than that it was not prepared to receive, and our gratuity did neither good nor harm; and no farther experiments were tried by us. Some persons might be inclined to infer from the result of our experiment that *shell marl* was in all cases useless; this would be no more correct than to say that as gypsum occasionally fails of producing the desired result, gypsum is useless.

The writer can call to mind an experiment tried by a farmer in Kent County, thirty miles south of London. He had one field which received much of his attention, but the crops he gathered from it were not equal to his expectations. Near by was a limekiln in which chalk was burned; the broken lumps, too nearly ground to powder to be thrown into the kiln, were gathered and spread on a strip through the middle of the field, and when the next crop made its appearance, the line between the *chalked* and the *unchalked* soil was plainly to be seen. The chalk contains ninety-five per cent., shell marl seventy five per cent., of carbonate of lime.

We must fall back upon our own convictions. We know that lime in some form, especially the *carbonate* of lime, is needed. We know that at a great cost per hundred pounds we restore lime as a sulphate or phosphate in a small measure compared with the amount we carry away, and we may know that *shell marl* would, in many instances, return carbonate of lime at less than one quarter the cost of far-fetched fertilizers.

Chemical analyses will tell us on what soil to apply it; Vermont perseverance will convey it to its needed place; and we may cherish a feeling of thankfulness that Providence has placed within our reach such a mine of fertilizing materials.

THE ANALYSIS OF FERTILIZERS.

BY HENRY M. SEELY, OF MIDDLEBURY,

The analysis of plants has shown their relation to the soil in which they are anchored and to the atmosphere in which they spread their green parts. The larger part of the plant comes directly or indirectly from the atmosphere and goes back to the atmosphere through burning or decay, The little residue or ash has come from the soil.

Analysis has further shown that out of the fifty-three elements composing the atmosphere and the earth, plants select but few for food. Chiefly among these are carbon, oxygen, hydrogen, nitrogen, calcium, magnesium, potassium, sodium, iron, sulphur, phosphorus, silicon and chlorine. Other elements are sometimes found but their presence is thought to be accidental rather than necessary.

These elements in some combined or co mpounded form are taken and appropriated by the plant. Quoting from Prof. S. W. Johnson we have the following facts in regard to the nutrition of plants:

"In regard to the food of plants, it has been settled that potash, lime, magnesia, iron, phosphoric acid, and sulphuric acid must be furnished to all agricultural plants through their roots and by the soil, in order to their growth

It has also been shown that soda, silica, and chlorine are not needful for the early growth of grain crops, but that chlorine is essential for the perfection of the seed, and that silica is probably necessary to uniform blossoming and ripening. It is farther proved that water must enter crops through their roots; that carbon, which constitutes more than half their weight, is superabundantly furnished by the air; that air and water together yield the materials out of which fully ninety to ninety-eight per cent. of crops is built up; and that the soil has to give for their nourishment but the two or eight per cent. of mineral matters which remain as ashes when they are burned, and the one-half to two per cent. of nitrogen which they also contain. It is likewise definitely settled that nitrates in the soil are the chief natural source of nitrogen, while the ammonia of manures, as well as a variety of substances containing nitrogen, and found in urine or formed in the decay of dead animals, likewise supply vegetation with nitrogen."

All the earthy ingredients of plant food must be present in every productive soil, and chemical analysis has shown that the majority of these are so abundant that so far as they are concerned the soil is inexhaustible. Some however are found in our ordinary soils in comparatively small quantities. It is noteworthy that most of the cultivated plants require large quantities of calcium, potassium, phosphorus, and nitrogen. Compounds of calcium are usually abundant in the soil, the others are there in limited quantity. The compounds of potassium, phosphorus, and nitrogen are drawn away rapidly by cultivation. In rare cases soils will yield year after year undiminished crops. But these are the exceptions. In general by the ordinary cropping soils diminish in their yield and in a comparatively short time the condition is reached at which cultivation is no longer remunerative and the land is said to be "worn out."

Fortunately our soils in Vermont are never actually exhausted, though they may for the time have reached the point at which they make no adequate return for the working. The rarer ingredients of a fertile soil so far as they are immediately available have been exhausted. Time will avail for the restoration of the fertility. The original constituents are still there in considerable quantities but bound up in the coarser or finer fragments of rock and the partially decayed vegetable matter forming the soil. Frost, and water, and the atmosphere, by the process known as "weathering" will unlock the treasured ingredients and change them to such forms, that dissolved in water they may be appropriated by the roots of plants.

As stated time will avail to bring back the lost fertility. But with the proper method of cultivation the "worn out" condition of land need never be reached. The soil is to be regarded, not as a bank from which unlimited resources can be drawn, but rather as a manufactory by means of which crude materials may be converted into valuable products, and that the amount of converted products will be according to the amount of raw material furnished, and the skill used in the manipulation.

To maintain constant fertility plant food must be added to the soil as fast as the crops take it away. Farmers in our older states at least are recognizing this fact and are acting upon it by saving and applying such manures as can be collected on their homesteads or gathered in their vicinity. But the demands of high farming cannot be met by the return to the soil of the coarse and scant materials left over after the great bulk of concentrated products has been sold away from the farm. The home made manures when carefully husbanded will go far to delay the exhaustion of the soil; but for the highest and most profitable results, some adjunct representing the crops and stock carried away must be added.

The results of the analysis of soils and plants and of experiments regarding plant food point out the fertilizers to be sought and used. Compounds of potassium, phosphorus and nitrogen in the form of potash, phosphoric acid, and ammonia or nitric acid, have been shown beyond all question to be the most efficient in the restoration of the fertility of the soil.

Such being the acknowledged power of these ingredients of plant food, it is not a wonder that substances rich in one or more of these are more and more sought after. The increasing demand has brought into requisition materials gathered from many sources.

Let us for a little look at the source of supply.

POTASSIUM COMPOUNDS.—Wood ashes have until recently been the source of enrichment of the soil in potash. The supply however has always been limited; perhaps never more than 30,000 tons have been gathered in all the countries in a single year. But the demands of the arts have drawn away a large portion of this, and only a small part has found its way back to the soil. But the mines of Stassfurt, Saxony, have put a half a million tons of potassium salts yearly upon the market, and from this apparently unlimited source both agriculture and the arts can hope for an abundant supply. Already these Stassfurt salts are going wherever advanced agriculture demands them.

PHOSPHORUS COMPOUNDS.—The supply of phosphorus compounds used to come almost wholly from the bones of animals, and these continue to be a great source. So the bones of domestic animals are gathered up to meet the demands of commerce But this supply is quite too limited and the bones of other than domestic animals are sought for. The prairies of Kansas and the West are gleaned over for the buffalo bones that have been accumulating upon them; and it is said that battle fields have been explored and the relics of human victims have been called upon to do humanity a further service.

But the bones of animals of whatever sort fail to contribute enough fertilizing material for the demands of an advancing agriculture. Supplies have been sought from the rocks with success. The fossil excrements of extinct reptiles—coprolites as called by the geologist—have been found a source of commercial wealth so that the privies of old time animals have been cleaned out in the interests of agriculture.

Still greater sources of phosphoric acid have been demanded and the demand has been met by the discovery of what promises to be an inexhaustible supply. Phosphorite, calcium phosphate confined to no particular geological formation, appearing now low down and now high up in the stratified rocks, has been discovered in many places and in many countries. In our own country the deposits of South Carolina are especially abundant along the rivers which empty their waters into the Charleston Harbor. On our borders supplies come from the Province of Ontario, Canada, while several of the smaller islands of the West Indies are peculiarly rich in phosphatic rock. Britain has been working away for years on her deposits of coprolites and now as estimated raises 200,000 tons annually. Phosphorites are abundant in Spain, France, Germany, and especially in Russia.

From these sources is derived the raw material that is wrought up into phosphatic fertilizers.

NITROGEN COMPOUNDS.—The sources of the compounds of nitrogen used for agricultural purposes are more various than those of potassium or phosphorus.

At the head of the nitrogenous fertilizers stands Peruvian guano, the partially decomposed exuvia of sea birds; valuable not only for its content of nitrogen but furnishing as well phosphoric acid and potash, the former in considerable the latter in small quantities. Soda, saltpetre from Chili or Peru, ammonia salts produced from the destructive distillation of bituminous coal and organic matters, bone meal, fish scraps, and slaughterhouse refuse, are other materials used in the preparation of nitrogenous fertilizers.

These substances named above containing compounds of potassium, phosphorus or nitrogen or all of these, some used without, but more with previous chemical preparation have been crowding themselves into the notice of conservative farmers in Britain and Germany, and have established a reputation for restoring the impaired or lost fertility of their fields.

And what they are doing for arable land they seem capable of doing for soils hitherto given up to barrenness and desolation. Prof. S. W. Johnson states:

"About the middle of last century, a lighthouse, known as the Dunston Pillar, was built on Lincoln Heath, in Lincolnshire, England. It was erected to guide travelers over a trackless, barren waste, a very desert, almost in the heart of England; and long it served its useful purpose. The pillar, no longer a lighthouse, now stands in the midst of a fertile and rich farming region, where all the land is in high cultivation. For twenty-five years no barren heath has been visible, even from its top. Superphosphate of lime, a chemical invention, first applied to land by the British chemist Murray, and brought to the notice of reading farmers by Baron Liebig, has been the chief means through which this great change was effected." Superphosphate over great stretches of English soil makes, or once made, the turnip crop. Turnips there support sheep, and with sheep the English farmer knows how to get rich on the poorest light lands.

Liebig, in 1840, called attention to the chemical composition of the guano of Peru. That very year a few casks were imported into England as an experiment. The next year 2,000 tons were brought, and in sixteen years its aggregated sales in Great Britain amounted to $100,000,000. Now Britain, Germany, France and our sea-board States cannot get enough of it.

With such results it is not a matter of wonder that these commercial fertilizers are winning their way into all our older States where a wasteful agriculture has impoverished a once fertile soil. In spite of the uncertainty of their composition, caused by a lack of knowledge, a lack of care, and a lack of honesty the demand for concentrated fertilizers is on the increase.

The fertilizers offered in market mostly go under the name of "superphosphates," the insoluble calcium phosphate or "bone phosphate" having been treated with sulphuric acid and so rendered more or less soluble.

We have perhaps no trustworthy data on which may be based an estimate of the quantity used in our own country. But the amount is enormous. Fair estimates for certain States and towns we have and from these we may form some idea of the amount demanded by the present system of agriculture.

The State of Georgia is officially estimated to expend annually $10,000,000 in the purchase of fertilizers. Secretary Flint states that many of the towns of Massachusetts are yearly paying from $25,000 to $45,000 for concentrated fertilizers. Prof. Johnson says that single towns in Connecticut expend annually from $30,000 to $50,000 for guano, phosphates, etc., besides using large quantities of home supplies. Number if we will the towns in the seaboard States and use this number as the multiplier of the above sums, and we get a glimpse of the amount of money paid for fertilizers by the farmers of the older States. And we may hope that the manufacture and sale may go on and increase until as an adjunct of the home gathered manures they may restore our fields to their original productive power.

This is to be noticed in this connection: it is not by the gross ton that the fertilizing value of these manures is to be reckoned, but by the actual amount of fertilizing material present, and the condition in which it exists. As previously shown the materials from which the commercial fertilizers are prepared differ widely in source, in composition, and in value. In addition to this the processes of manufacture are variable and too often imperfect. The results are just what should be expected from the nature of the case. The character of these fertilizers is diverse, and they range from the excellent down to the worthless.

Some test whose accuracy cannot be disputed must be sought, one that will set at rest the question of their actual worth. Among the most valuable contributions made by science to the agriculturist is the knowledge of the true character of the commercial fertilizers offered by importers and manufacturers. Opportunities for falsification are many, means of ready detection few. A chemical analysis is the only test practicable. Agricultural societies and boards early saw the necessity of helping the farmer in determining the value of the fertilizers he was to buy. The oversight which such bodies have exercised, has no doubt saved the country thousands and thousands of dollars that would otherwise have been sunk in the purchase of worthless articles. In the manufacture and sale the general result has been most satisfactory. Articles of no value have been driven from the market. Fair minded and honest manufacturers are more careful in their methods and endeavor to give an article of uniform composition, frequently offering with the sale to guaranty their wares.

The Vermont State Board from the beginning appreciated the necessity of controlling as far as possible the character of the fertilizers put upon sale, being quite unwilling that the valueless, falsified, or deteriorated materials rejected by other States where oversight is had, should find a market here. Though the individual members of the board have been wholly changed, still a uniform course has been pursued and the good work has gone steadily on. Under the direction of Professor Collier, the former secretary, they have from time to time gathered from various sources the different fertilizers offered for sale within the State, and have submitted these to chemical analysis. No better evidence of the wisdom of this course is needed than that afforded by the fact that the average value of the fertilizers now offered in market is over thirty-three per cent. greater than when the first analyses were undertaken. These careful analyses by Professor Collier have been of more value than can well be estimated. The improvement in the character of these fertilizers is largely due to the scrutiny to which they have been subjected. The inducement to put upon the market an article of no value is largely removed, as the attempt to do so is liable to be detected at the outset.

It is thought it will be a timely service to the farmer to put before him in a condensed form the excellent work of Professor Collier, that at a glance he may know the value of the different fertilizers as revealed by chemical analysis. These results have been published at different times in a little different form, a part, the first series in the report for 1872, the second series in the State agricultural papers.

Other ingredients than those mentioned below have manurial value, particularly potash and gypsum; the first is usually present in too small quantities to be regarded, and the second is too cheap to be estimated as an ingredient of a high priced fertilizer. The ammonia and the phosphoric acid are the chief ingredients of value in these compounds, and according to the amount of these in any given sample, so will its actual value be.

The condition which the phosphoric acid is in, whether soluble in water and so ready to be used at once by the plant; or reverted, that is, having once been soluble, but on its way back to the opposite condition, and yet soluble in some alkaline salt; or insoluble, that is, not soluble in either of these, but soluble in acids, will also determine to a great extent their worth.

Upon the amount of actual or potential ammonia, and upon the amount and condition of the phosphoric acid, the following values are calculated, and upon a ton of 2,000 pounds. The market value of these substances in other forms will be a guide in estimating their value in a manure; and there is a pretty uniform basis upon which agricultural chemists have settled the price of these rarer ingredients.

Professor Collier in the first State Report, that of 1872, adopted the following estimation of values, which is adhered to here, as it will afford a good means of comparison with the results of the more recent analyses. This scale of prices, as the Professor has recently said, is manifestly too high, as equivalents can now be purchased in the market at less rates.

In the first part of the second series the reverted and insoluble phosphoric acid were not separated, and both are reckoned together as insoluble.

Soluble Phosphoric Acid....	16 1-4	cents per lb.
Reverted " "	13 1-5	cents per lb.
Insoluble " "	6	cents per lb.
Ammonia..................	25	cents per lb.
Potash....................	7	cents per lb.

The average value calculated from the analyses of the twenty-six fertilizers of the first series was $45.01 per ton, while the average of the last half of the second series, those last made, is $58.95, an increase of thirty-three and one-third per cent. This result is in perfect keeping with similar cases the country and countries through; wherever the fertilizers sold have from time to time been subjected to chemical analysis, the quality of the fertilizers has steadily improved, the good growing better, and the comparatively worthless dropping out of the market.

Tabulated Analyses of Commercial Fertilizers and Values.

I, Series 1872.		Per cent. comp.					
Name.	No.	Soluble phos. acid.	Returned phos. acid,	Insoluble phos. acid.	Ammonia.	Value.	Received from
Fales' Fertilizer,	1	.64	1.15	5.39	2.58	$24.49	Burlington.
Miles & Co.'s,	2	8.59	.00	.41	2.88	42.81	Northfield, Mass.
Bradley's X L	3	5.95	.55	5.30	2.96	41.95	Boston, Mass.
Bradley's B D,	4	4.85	1.05	6.81	2.93	41.35	Boston, Mass.
Bradley's B D,	5	5.29	2.84	7.61	2.13	44.47	St. Johnsbury.
Bradley's Patent,	6	4.53	2.63	7.20	3.25	46.66	Boston, Mass.
Bradley's Patent,	7	1.49	4.50	6.89	2.17	35.84	Hartford.
Bradley's Patent,	8	6.40	2.75	3.40	3 01	47.32	St. Johnsbury.
Enoch Coe's,	9	9.76	1.37	1.10	2.89	51.[illegible]1	Burlington.
E. Frank Coe's,	10	7.85	5.76	4.60	3.05	61.49	Essex Junction.
Russell Coe's,	11	6.19	6.28	2.75	1.36	46.79	Middlebury.
Canada Superphosphate,	12	7.23	.22	3.07	1.93	37.41	Charlotte.
Canada Superphosphate,	13	12.96	1.46	5.56	2.17	64.69	Charlotte.
Green Mountain,	14	14.46	.00	8.43	.00	73.37	Burlington.
Green Mountain Ammon	15	18.68	.00	8.09	1.03	75.57	Burlington.
Paddock & Dean's,	16	.35	1.81	2.71	1.49	16.62	Lunenburgh.
Brighton Phosphate,	17	3.48	8.69	1.57	1.86	45.43	Boston, Mass.
Brighton Phosphate,	18	8.38	6.55	2.57	2.42	67.62	Boston, Mass.
Brighton Tobacco Grower,	19	.69	10.79	1.45	1.87	41.82	Boston, Mass.
Wilson's Superphosphate,	20	3.86	5.05	1.50	3.40	44.67	Northfield, Mass.
Wilson's Tobacco Grower,	21	3.45	3.69	1.01	2.25	33.41	Northfield, Mass.
Bower's Manure,	22	2.73	8.08	12.67	.69	48.83	St. Johnsbury.
Union Fertilizer,	23	.00	.00	1.65	.88	6.38	St. Johnsbury.
Cumberland,	24	5.55	3.78	4.92	3.07	49.17	Newport.
Cumberland,	25	5.35	4.86	3.18	2.49	46.49	Hartford.
Watson & Clark's,	26	6.06	2.60	3.46	.75	34.61	Philadelphia, Pa.
Grafton Mineral Fertilizer,	27	.00	.00	.00	00	2	Lunenburgh.
Stevens' Mineral Fertilizer,	28	.00	.00	.00	.00	2	Newport.

Tabulated Analyses of Commercial Fertilizers and Values.

II, Series 1875.		Per cent. comp.					
Name.	No.	Soluble phos. acid.	Reverted phos. acid.	Insoluble phos. acid	Ammonia.	Value.	Received from
Bradley's Superphosphate,..	1	7.93	.62		3.45	$43.77	Ludlow.
Peruvian Guano,............	2	6.19	13.74		11.73	95.26	Boston, Mass.
Complete Manure,...........	3	.46	.73		.42	3.42	Gaysville.
Brighton Abattoir, ...	4	.82	8.19		6.72	46.09	Boston, Mass.
Bay State Superphosphate,..	5	11.60	3.91		2.72	55.99	Boston, Mass.
Quinnipiac Fertilizer, ...	6	8.38	4.19		4.90	56.71	Brattleboro.
Wilson's Ammon. Superphos.	7	1.71	11.83		1.91	29.3	Morristown.
Bradley's Patent,............	8	8.42	6.92		2.56	48.47	Barre.
Animal Dust,................	9	.78	7.64		8.51	54.25	Montpelier.
Lister's Superphosphate, ...	10	11.65	2.95		1.97	51.25	Philadelphia, Pa.
Brighton Abattoir,...........	11	.72	4.01	7.05	7.31	57.94	Brattleboro.
Upton's Superphosphate,....	12	2.54	10.80	5.56	4.46	65.74	Hartland.
E. Frank Coe's,..............	13	9.37	2.93	1.17	3.40	56.59	Hartland.
Bradley's X L,...............	14	3.14	3.49	4.43	4.70	48.24	Windsor.
Peruvian Guano, ...	15	5.19	7.60	2.11	13.85	108.71	Burlington.
Cumberland,.................	16	5.36	7.99	.62	3.06	54.55	Middlebury.
Bradley's Patent,............	17	5.25	2.85	6.94	3.40	49.91	Middlebury.
E. Frank Coe's,..............	18	10.71	.31	.31	2.68	49.46	Brattleboro.
Cumberland,.................	19	5.97	.93	2.88	2.89	40.23	Ludlow.
Enoch Coe's,................	20	9.48	3.02	.62	3.74	58.22	Ludlow.

GRASS CULTURE.

A PLEA FOR GRASS CULTURE.

BY J. C. SHERBURNE, OF POMFRET.

Travellers tell us that the ruins of Eastern cities, whose names are famous in ancient history, are found in the midst of deserts, whose barrenness supports only the scantiest vegetation. While we are wondering how cities could exist and flourish with a totally barren country surrounding, how their vast population could possibly be fed out of such leanness and barrenness, the philosopher in agriculture comes in with this explanation—the exhaustive system of husbandry practiced, the continual drafts made upon the soil which came of certainty from grain raising, completely absorbed all fertility from the soil, which at first, in order that the multitudes might be fed, must have been wonderfully productive.

All about us, on the hills of Vermont, and year by year creeping slowly but surely downward into the valleys, are found the utter and irredeemable ruins of homes and farms. Standing by these broken walls and looking upon the sheep as they nibble the vegetation so sparse that a hundred acres is hardly sufficient for an equal number of sheep, we ask the question, How could the fathers possibly from such soil manage to feed themselves and their houseful of children? and the oldest inhabitant immediately steps forward and says he has seen growing on the very spot and all around, year after year, enormous crops of all kinds of grain; and we find that the history of thousands of years ago is repeating itself to-day, so far as it relates to agriculture.

The continual western movement of men and families comes in a great measure of something closely resembling the instinct observable in the rats as they desert a sinking vessel. It matters not from what sources or how frequently come the exhortations, "Don't leave the old place," "Stick to the farm, young man." Starvation sure and ultimate is never welcome though the years go by befor its final and complete triumph.

We affirm that the giving up of farms to pasture lands witnessed all around us (and there is no pleasure in the sight) comes chiefly of the nearly complete exhaustion of all fertility of the soil by the ruinous practice of grain growing. The continuance of homes among these hills, the interests of the farmer and the welfare of the State demand a different system of agriculture. Whatever else may be given up, or whatever else may be purchased advantageously in the markets of the world, Vermont, next to her own men and women, must raise her own grass.

Grass is the commonest of all vegetation, in itself a thing of beauty, growing in all soils, ranging through every conceivable degree of luxuriance and sparseness.

It is almost as common as the air, and this very commonness may, in some measure, account for the lack of attention which it receives. It receives less direct culture than either corn or potatoes or oats, yet, in market value, it exceeds the combined aggregate of all agricultural products. The announcement that "All flesh is grass" is doubtless intended to convey lessons respecting the brevity of human existence, yet we have no occasion for dispute with the man who reads, "All flesh is grass," and accepts the bare, literal statement.

The soil of Vermont is particularly adapted to the growth of grass; as a grazing State it ranks first among the States of the East; as practical proofs of this may be mentioned the reputation which comes of Vermont horses, the excellence of her dairy products, and the unequalled notoriety of Vermont sheep. Grazing in this latitude implies an abundance of forage for the winter's use, of at least six months' duration.

But the conservative farmer will object to the direct culture of grass to an extent corresponding to its importance, compared with other field products, as such implies special farming. Specialty is an outgrowth of an advanced civilization, and it has a close connection with comfort and refinement. It is clearly observable in manufacture, in trade, and in the professions, and more and more in agriculture. I have somewhere read this sentiment: "Look out for the man with one idea—he is irresistible."

Grass readily responds to generous treatment; unlike other field products, it may be grown upon the same soil year after year, indefinitely, without deterioration. It draws very lightly upon the fertility of the soil; it is the least exhaustive crop with which we are acquainted. A thorough preparation of the soil is sufficient for several years; it requires no attention while growing, and, with the improved machinery for haying, securing the hay crop, if commenced in season, is the pleasantest work of the farm.

Ask the farmer who represents a very large majority of his class, how much grain he intends to raise the coming season, and he will invariably answer all he can; implying that he will have as many acres under tillage as possible, limited only to a certain extent by the fertilizing accumulations of the farm; and objection is made to the direct culture of grass, as thereby the amount of grain that would be raised would be largely diminished. Let us examine this objection. Grain growing requires constant care throughout the season; it involves a large expenditure of man power. Upon these hills, the planting, the husking, the cribbing, the shelling, must all be done by hand, and whatever is done by hand nowadays is done slowly.

During the growing season the farmer is the busiest of all business men; work presses in every direction; before one thing can be completed other things have an unpleasant way of demanding immediate attention.

The last hoeing, which cannot be neglected, is performed when the whole force should be vigorously engaged in the hay field. Under the present arrangement nearly the entire hay crop has to be secured at an unreasonable time, for the farmer, like

> "——Don Fernando,
> Cannot do more than he can do."

From careful observation in my own experience I am satisfied that a ton of hay, secured on the first day of July, fed to dairy cows in milk, has a value of several dollars over an equal amount secured two weeks later, or on the fifteenth of July. With the exception of wheat, of which comparatively little is raised, a very small amount of all other grain is used for food in the family; with the exception of what is consumed by pigs and poultry, it is fed in connection with hay. After careful consideration, knowing the unsurpassed excellence of early cut hay, I make this statement without hesitation: If the entire hay crop of the State could be secured at the best possible time, its value, when fed, would exceed the worth of the hay now obtained together with all the grain raised in the State which is fed in connection with the hay.

Again, objection is made to giving up some portion of grain raising for grass culture on the ground that grain raising is largely profitable. It is claimed that the corn crop is the best crop raised. Statements are frequently made, and occasionally find their way into the public prints, that corn hereabouts is produced at a total cost of thirty, forty and fifty cents a bushel. Such statements may be matched by the assertion, equally reliable and worthy of confidence, that the best of English hay may be grown and secured in the barn at a cost not exceeding five dollars a ton. These figures, if they prove anything, prove too much, and are admirably calculated to mislead, for, when the leading field crops can be produced at a cost of less than half their market value, the question, "Does farming pay?" will be satisfactorily answered for all time. In ascertaining the exact cost of our farm products there are questions involved looking before and after, and the mathematician, or philosopher, or chemist, or scientist has not yet made his appearance who is able to calculate a rule that will measure the exact cost of any production of the farm. It is clearly evident, however, that, at present prices, the greatest possible amount of grass that can be grown upon an acre will exceed in value the greatest possible amount of corn that can be grown on an equal area of land.

But I am told that the farmer, if he does not cultivate grain for the market, should at least raise all the grain his own use requires; and I am asked, "Is not the practice which is coming more and more upon the farmer, in incurring large expenditure for Western meal, ruinous?" Quite the contrary—the feeding of Western meal is the redemption of Eastern soil. Take a practical illustration directly to the point. The owners of the farms lying in the valley commencing at this place and stretching northward some two and a half miles for several years have fed large quantities of Western meal. Meal and bran have been purchased by the ton and by the car load and have been fed freely and liberally, without regard to cost. The appraisal of the farms in this valley by the assessors in 1874 shows an increase of nearly one-third over the appraisal made in 1870. To one who is accustomed to turn his philosophy to practical account it is clearly evident that Western meal is largely chargeable with this unprecedented increase of appraisal of real estate.

It is not the purpose of this paper to discuss the means to be employed in grass culture. I wish, however, to call attention to two considerations which, at present, are outside the ordinary line of farm operations, namely: The running of water out of land where it is not needed and the running of water on to land where it is needed.

On nearly all farms there are lands given up wholly to the growth of grass, producing but a small quantity of very inferior quality. These lands, in the parlance of the field, are called swales and are not only unprofitable but unsightly upon any estate.

As the farmer, on a winter's evening, while without is storm and bluster, sits by his comfortable fire and, looking therein, sees the shake of the head and the imploring look of his mild eyed cows and oxen, which say, in language unmistakable, take away this swale hay, the poorest of all poor fodder, and give us something fit to eat; and, knowing that the soil yielding such miserable returns is made up of rich deposits, the accumulations of thousands of years, waterlocked; and, knowing there is a limit to what he can accomplish in the busy season, let him resolve to give up the coming summer at least one acre of the hoed crops and devote the time and attention to the permanent reclaiming of an equal amount of swale land, and, having resolved to do it, let him do it, and he will have made an investment sure and profitable, and, if properly cared for, paying large dividends thenceforward forever.

Again, there are on many farms lands light and dry, producing but a small amount of vegetation, which, by their position in reference to streams of water, are specially adapted to the growth of grass—the water not only giving moisture but fertility. If one would see a wonderful growth of grass, let him irrigate and then top-dress. In the music of the murmur of our mountain streams, in their way onward to turn the wheels of the mechanic and manufacturer, there comes the voice, we can aid in agriculture.

But I am asked the inevitable question—Will it pay? Will this new departure in farming, as it is called, pay? The answer to this question is suggested by other questions like the following: Is the leisure which may come of a system of farming devoted to the culture of grass worth anything to the farmer and his family? Is the satisfaction of seeing one's estate increase in beauty and fertility worth anything? And, last and least, but most practical, will it pay for the farmer to pay his debts?

INCREASING THE GRASS CROP.

BY N. SKINNER, OF PLAINFIELD.

MR. CHAIRMAN, MEMBERS OF THE STATE BOARD,
LADIES AND GENTLEMEN :

After consenting to exemplify this "green subject" by my personal appearance in public, I was directed, in the kindest manner possible, by the Secretary of this Board, to prepare myself for this occasion by "dusting with grass seed," the evident design being, in the absence of mature thought, to bridge the deficiency by means of physical contrast. But as I do not allow any of my grass to mature seed, always cutting it green, and being unwilling to borrow, I find myself entirely destitute of any ripe idea which the suggestion indicates. Therefore, in the absence of all thoughts and theories, I am compelled to hazard the chance of being called egotistical by relating some of my own experience in increasing the grass crop, which has been so simple that I fear it will not interest any one. But, although I have been moderately successful, yet I assure you that I look upon my success in the same light that a certain man did upon his devotions. When the new clergyman inquired of him if he had religion, he replied, "None to brag about, sir."

That grass is the most important and valuable of the crops grown in Vermont, and that it ought to be increased instead of being allowed to decrease, I think all will admit without debate. Grass is king in Vermont. His most powerful enemy is the plow, though in isolated cases the plow is his ally.

Eight years ago, I bought the farm where I now live. Nearly the whole farm had been plowed. Potatoes had been raised for the starch factories, grain had been sold, etc. The mowing field, containing fifty-five acres at the time of the purchase, produced hay of very poor quality, sufficient only to winter eight cows.

At present about one-third of the field is fenced off with the pasture; the remainder cuts hay and rowen enough of good quality to winter twenty-five cows. And, comparatively, the improvement has but just commenced. Yet perhaps the hardest struggle is past, as the crop begins to breathe freely, and is, at least, in a self sustaining condition. And this result, although so insignificant when compared with what Professor Spaulding and many others have done, has been accomplished without the aid of a single dollar's worth of commercial or foreign fertilizers. The next spring after buying the farm, I raised up the old barns, shoveled out the dirt, which was saturated with the drainings of the stables and yard; made a cellar under the stable and supplied it with muck; dug the chip dirt out of the dooryard and woodshed; removed the dirt where slops had been thrown and sink spout had drained, and supplied its place with muck and fresh earth. And this digging out and replenishing was continued around every old shell of a building on the place, until each became odorless. This accumulation was used as a top-dressing for grass, being spread on evenly the next fall, and it proved of great benefit. During four years my cows were stabled at night, summer as well as winter, and the trenches and cellar were supplied with sufficient absorbents, loam, muck, scurf, leaves, sawdust, straw, anything at hand, making about as much manure in summer as in winter. Nor was the hog-pen forgotten, the swine making as much value of manure, by means of absorbents, as they themselves were worth when dressed.

After stabling my cows at night in this manner for four years, and top-dressing the mowing, the grass crop had increased in it so that the mowing and pasture were very unequal in their production of grass. Although the pasture contained three times as many acres as the mowing, the feed in summer was not sufficient for the stock required to eat the hay in winter. I therefore determined to try and improve the pasture by turning the cows out at night, not forgetting to give them a little more meal every day. This item of meal I consider a very efficient means of increasing the grass crop, and think that the produce of the pasture has nearly doubled since adopting the foregoing method. I have much more faith in meal than I have in commercial fertilizers, as I have always found it true to kind and true in its operation.

Another item of importance is to cut the hay green, as the manure made from feeding early cut hay is much more valuable than that which is made from late cut hay.

Never use the mowing for grazing purposes, either in fall or spring.

When the feed grows short in the pasture cut and feed rowen to supply the deficiency, so as not to injure the pasture by feeding too close. I usually feed my cows nine months in the year with hay or rowen, and a little meal every day that they give milk. Never fail to top-dress after taking off rowen, and do not cut the second crop beyond where you have sufficient manure to cover, except in a small part of the field that is very rich. Taking two crops a year from a field without any return, I consider dishonest, and should expect soon to meet with failure. However sharp we may be in our dealings with each other, it is absolutely certain that we cannot cheat nature.

I have assumed in these premises that to increase the grass crop more manure must be saved and applied; that there are abundant resources on every farm where a dairy is kept' if rightly economized, to supply fertilizers that will, when properly applied, increase the grass crop to an indefinite extent.

There is sometimes a great failure in the manner of applying top-dressing. Some do not think of that dignified term *cultivate*, as being applicable to grass roots and blades, but say, let it grow. And yet it is as necessary to cultivate grass in the true sense of that term, as it is to cultivate any other crop. We are very careful to place well pulverized fertilizing matter over the roots and around the blades of our so-called cultivated crops. We do not allow large lumps of any kind to lie upon their struggling blades, but we pulverize and grind it into food which the plant can assimilate. We should do the same by grass. Spread top-dressing from the cart as evenly as possible; draw a heavy bush over it, and follow with a garden rake and make it fine. If it takes as long as it would to hoe the same amount of land in potatoes, "*so mote it be;*" *stick to it* and your land will be in much better condition than it would have been if you had raised and sold the potatoes. Apply top-dressing in the spring, after haying, in the fall, at any and at all times when the ground and the grass are in suitable condition to work upon, remembering that discretion and some botanical knowledge are essential to success.

There is one consideration which I deem of importance in this method of applying manure, and that is that it not only yields as great a present profit with less labor than it is to plow extensively, but it gives a greater and more permanent improvement to the land. Thus it gives us the opportunity of "eating the loaf, and saving it for our children."

Besides this there are many side issues of importance connected with this method. I will mention only one. Much of the manure that I have spoken of for top-dressing would hardly pay for applying to plowed land; yet on the saving of these fertilizers, which are of great value when applied to grass lands, the comfort of our domestic animals and the health of our families are dependent in a great measure.

For example: I have a large family, and live in an old house. The fashionables would call it a very poor house; without modern improvements, as it is not covered with a mortgage. Raising grass has raised the mortgage. But we have not had a case of fever or any malignant disease in our family, and I am certain that the free use of absorbents has been a preventive of disease. Whenever I discover the odor of decaying matter I consider it a warning of approaching danger, and a notice that some fertilizing properties are wasting, and I deem immediate attention of so much importance that I should not neglect it unless my house was on fire or my wife dying. No matter from whence the warning comes, whether slop hole, water closet, pig-pen or stable, hasten to the spot with muck, fresh earth or some other absorbent, and we at once secure two objects, fertility and health. A few years ago, a man remarked to me: "I see you have improved your farm, how shall I improve mine?" My reply was, "Look under your feet." He had lost half his family with putrid disease, from the effect of those poisonous exhalations which, if properly husbanded, would have enriched his fields instead of destroying his loved ones. I have seen men drawing home commercial fertilizers, while the liquid manure from their yards and stables was running off in the ditch by the roadside, and their slopholes were emitting the most offensive odors. Such cases should remind us of a certain text of Scripture: "But the eyes of a fool are in the ends of the earth." (Prov. xvii : 24.)

Then let us, like loyal subjects, stay at home, look under our feet, and increase the dominion of this sovereign crop, until it shall be independent of circumstances and condition of season.

GRAIN CULTURE.

DOES IT PAY TO RAISE CORN IN VERMONT?

BY WILLIAM CHILD, OF FAIRLEE.

In the few remarks we may offer on this question, it is not with the expectation of enlightening others so much as to elicit remarks from all who take an interest in the increase of growth of this important field crop.

And in whatever may be said on this subject please allow me the affirmative side, hoping to provoke such discussion as will show the cultivation of this grain in its proper light.

In making my estimates, I have allowed one dollar and fifty cents for each man per day, including board, and the same for each yoke of oxen or span of horses; and for boys from one-half to three-fourths the amount of men's wages, according to their ability.

As the quality of the manure used by us in the cultivation of this crop is generally of the coarsest kind, we have estimated its value at one dollar a load, say half a cord to the load, and charged the crop with only half that value; believing succeeding crops receive full as much benefit as the corn crop.

When we compare the cost of raising a given amount of corn in Vermont with that of the Western States, the odds are decidedly against us, and it is often said that it don't pay to raise corn in New England, because Western corn can be delivered here at a cheaper rate than we can raise it. And when we think of Western farmers cultivating their thirty, sixty or ninety acres with one or two men and a horse, it certainly looks like uphill business when compelled to spend as much, and perhaps more labor on eight or ten acres; and then the idea of bending our bodies over a hoe handle day after day, under a scorching sun, in the long days of June and July, is not the most pleasant idea to contemplate.

But how will the two cases compare as applied to the Eastern and Western producers when a sale is effected? Then the Vermonter's ten acres will bring about the same amount of currency as the Hoosier's thirty or forty; and then the amount of labor in harvesting, husking and marketing is much less for the Yankee, than for either the Hoosier or the Buckeye. But, for the sake of argument, admit for the time that it costs less to buy Western corn than to raise it in Vermont. Permit me to ask the question: what are we to buy with? Most of us farmers need the avails of all our surplus produce to pay our running or current expenses, and can scarcely keep even at that. And how are we to pay for Western corn? *He who knows will please answer.*

I am aware that it is a sad dilemma for us farmers to be without corn and no money to buy with, for to be without corn is nearly equivalent to being without beef, pork, mutton, wool, butter, cheese, poultry and eggs, and all other things which ordinarily grace a farmer's table or enrich his household.

In proof of this allow me to quote from remarks of J. H. Ewbank of Tennessee, as published in the United States Report, Department of Agriculture, for the year 1866, as follows:

"Indian corn has become so important and valuable a food in our country, both for man and beast, that it is fully equal, and in many respects superior to wheat, as it grows well in all the States, and is a surer and more abundant crop, and hence more reliable, as a source of revenue, than any other of our cereal grains.

"It produces more bread, more meat, more milk and butter than any other grain crop.

"In the Southern States it forms the constant and principal food for man and beast, and poultry of all kinds.

"It makes fat steers, fat bullocks, fat cows, fat hogs and fat poultry, and these in their turn enrich our tables for the use of man. Hence our people have great reason for regarding Indian corn as the "king of grains," the staff of life, the great stand-by of farmers; and he who considers its excellence and cheapness as an article of food, and the great value of the bountiful growth of stalks and leaves it produces, will certainly not deem this praise extravagant."

Professor Johnston, of New York, also says, in a similar report for 1865: "The most valuable of the cereals for fattening purposes, both from its composition and the profitable returns attending its culture, is undoubtedly maize or Indian corn.

"Its analysis exhibits an abundance of fat forming principles, and also a liberal supply of the nutritions."

As some figures are necessary to show the actual profit or loss in cultivating corn in Vermont, we herewith subjoin a few facts and figures which are in accordance with our experience in relation to the cost of raising this article, taking as a basis for calculation a field of ten acres.

DEBIT.

To breaking ten acres greensward	$40 00
Carting 200 loads of manure	30 00
Spreading and plowing in manure	20 00
Harrowing	5 00
Planting with machine or planter	4 00
Hoeing twice, and horse to cultivate	30 00
Cutting, binding and stooking	25 00
Carting and husking	30 00
200 loads of manure, coarse and strawy	100 00
Interest on land	30 00
Shelling and marketing	10 00
Tools and incidentals $10; seed cord $4	14 00
Cost of crop	$338 00

CREDIT.

By 400 bushels of corn at 75 cents	$300 00
20 tons of corn fodder	100 00
30 loads of pumpkins	20 00
Market value of crop	$420 00
	338 00
Net income from ten acres	$82 00

By the foregoing demonstration we find a clear profit of eighty-two dollars on the ten acres, or eight dollars and twenty cents an acre. Nor is this all our gain. There is no crop that the farmer can raise that will fit his fields for future crops of either grain or grass like a well tilled corn crop. And the crowning profit is the happy consciousness of having acted well our part by contributing to the general good.

And now when the revolving year brings the rich harvests of autumn, with what satisfaction do we view our well filled cribs of golden corn, producing bright and happy visions of fat beef and pork, mutton and poultry, and an occasional hot and well buttered johnny-cake.

And who can be so ungrateful as not to join in heartfelt gratitude to the Giver for crowning our labors with such abundant success?

Experiments as to time of ripening of different varieties of corn, all planted May 10th. Soil and treatment alike in each case. Made by J. C. & R. Jaques, of Essex County, Massachusetts.

Early Dent. Ripened August 5th. Yield per acre 49½ bushels. Shrinkage from time of husking to January 1st 20 per cent.

Dutton. Ripened August 11th. Yield per acre 47¼ bushels. Shrinkage from time of husking to January 1st 25 per cent.

White Australian. Ripened August 17th. Yield per acre 72½ bushels. Shrinkage from time of husking to January 1st 19½ per cent.

Cherokee. Ripened August 28th. Yield per acre 56½ bushels. Shrinkage from time of husking to January 1st 27 per cent.

Sanford. Ripened September 5th. Yield per acre 45¾ bushels. Shrinkage from time of husking to January 1st 28 per cent.

SAVING SEED CORN.—According to experiments made in saving seed, the first ripe ears, picked from the field before harvest, will produce a crop four to six days earlier than seed from the same field saved at the time of husking.

FRUIT CULTURE.

APPLE CULTURE.

BY J. H. PUTNAM, OF GRAFTON.

We are Yankees. This is an age and we are a people of utility. Will it pay? is the test to which everything is brought. Consequently, in considering the matter of planting an orchard, the first query that arises is this: Is it reasonable to expect that the requisite amount of mone y land and labor invested in orchard culture will yield as large returns as though invested in any other ordinary farm product? We answer, yes. We contend that there is no ordinary farm crop from which so much can be realized as from the apple orchard, in proportion to the capital and labor invested—it being understood always that the situation, soil and climate are suitable.

We would not expect to succeed in orchard culture on the crest of the Green Mountains or in high northern latitudes, neither should we look for success in a bed of sand, but, where the apple tree grows spontaneously, comes up of itself in the fields and pastures, grows and produces fruit in spite of neglect, we have reason to expect that, with good culture, our efforts will be crowned with success, for in this, as in the growing of every other crop, good culture is the requisite of success. Many who undertake the raising of fruit pratically ignore this fundamental truth, and act as if they believed the age of miracles not yet passed; and, setting their trees much as they would a post, conceive their duty in the matter accomplished, trusting, doubtless, that, by some special interposition of Divine Providence, the laws of vegetable growth and production will, in this case, be reversed for their benefit. We are told by good authority that "Faith without works is dead," and the fruit grower will find that this applies to his calling as well as to everything else.

It being settled by the farmer or land owner that he will set an orchard, and being convinced of the necessity of thorough cultivation, the natural inquiry with him is, "How shall I proceed in order to produce the best results?"

A practical reply to this question is the object of this paper.

ASPECT.—As regards aspect, not much can be said which is of general application, the conditions of soils in different localities varying—the geological formation being such that in some localities the lands of one exposure are much more fertile than those of another, but other things being equal, would choose a southern or eastern exposure rather than a northern or western.

Soils are of endless variety, from the sand bank to the swamp, and many of these varieties are well fitted for orchard growth. In most localities among the hills of

Vermont those soils which will produce good crops of corn may safely be planted with orchards.

PREPARATION OF THE SOIL.—Perhaps as good preparation as the soil can receive upon which trees are to be set is that which a good farmer would give to the same field were he preparing it for a premium crop of corn.

The usual method with those who are trying to do the thing just right, and at the same time think they can cheat nature a little with impunity, is to break the ground, manure heavily for two or three years, planting the ground with hoed crops, and perhaps the third year set the trees, sow with grain and seed down to grass. Upon *some* soils and under *some* circumstances trees subjected to this treatment may do well, but it will be in spite of the treatment, not because of it.

The better method would be to set the trees at the time of planting the second hoed crop, or when the soil has become well mellowed, thereby giving the trees the benefit of that year's cultivation and continue that cultivation ever afterwards.

I can anticipate the objection which will be urged against planting a hoed crop with the newly set trees, that is, the inconvenience of cultivating such a field. This, it seems to me, is the only objection which can be urged against this plan; but, if care is taken to so arrange that the rows of trees will be directly in line with those of corn, the inconvenience will, in a great measure, be obviated; and, furthermore, I know of no way of succeeding in any honest pursuit independent of some hard labor, of some inconvenience. And to this general rule fruit raising is no exception.

In regard to the *distance apart* which trees should be set, there is a great diversity of practice—some recommending forty feet each way, some two rods, others twenty-five feet, others twenty feet, and some even less than this, in which case much fruit can be obtained before any crowding of the trees, and, when this does occur, some of the poorer trees can be cut out. My own practice has been to set twenty-five feet apart, giving seventy trees to the acre.

DIGGING THE HOLES.—If the soil is in good condition, well pulverized and friable, no great digging will be required, simply digging a hole deep and broad enough to admit the roots without twisting or crowding. It is sometimes recommended to dig deep holes and fill with some fertilizing material. This, if the subsoil is a hard-pan and undrained, is worse than useless, for we shall then have a fine dish to hold cold water, and cold, stagnant water about the roots is death to any fruit tree. If from any cause it is deemed advisable to set trees in an unbroken sod, dig the holes broad but not deep, applying, at the time of setting, a liberal amount of fertilizing material; but much the better way is to make the soil "all hole," in which case but little extra digging will be required.

It is well to have the ground fully prepared and the holes dug before procuring.

THE TREES.—As it is not advisable to keep the trees exposed to the sun and air longer than is absolutely necessary, now comes the question, "Where shall the trees be obtained?" If you have raised your own trees upon your own soil and have taken proper care of them, you are a lucky man. Use them by all means. If you have none (and the chances are strong that you have not), procure good trees from some other source, and it does not matter much from what sonrce, if the trees are good. Get trees which have made a healthy, thrifty growth, that have neither been forced nor stunted, and the chances are strong that you will be better satisfied, everything else being equal, with trees grown in your own vicinity, than with those bought of foreign tree venders.

Let me not be understood as condemning the whole race of *tree peddlers*; they are not *all* of them necessarily unmitigated scoundrels. A man may travel about the country selling trees and at the same time be honest, but it is an undisputable fact that people have sometimes been woefully bitten. Selling a new, unproved variety of grape at five dollars per plant and furnishing a poor plant at that, selling the Tetofsky apple at one dollar per tree and making folks believe the scion with which the tree was grafted came from Russia, selling people an endless variety of trees, many of which are in no wise adapted to the locality, and which, with the best treatment, will never prove profitable, promising to furnish first-class trees, going to the large commercial nurseries of the West and buying the refuse trees which the nursery-men will not send out themselves, and with these filling their orders—these are a few of the sins of some tree agents, which the whole class are, in a measure, unjustly obliged to answer for.

THE BEST SIZED TREE.—For setting, I think that one that has grown from three and one-half to four and one-half feet and then branched, as soon as it has thrown out branches at that height, is of the proper size to set. If allowed to stand in the nursery rows longer than this nothing will be gained, for, as the trees grow, the roots also grow and, in taking up, as many roots are saved on the younger tree as on the older, and consequently there must be a greater proportion of loss on the larger tree, and, as a general rule, it will be found in practice that the smaller trees will be the more successful—then, I say, do not choose overgrown trees but those that are smallish, well rooted and thrifty.

After the trees have been procured and taken home, if they are to be kept any length of time before setting, they must be heeled in, that is, the roots must be buried in the earth. When ready to set, take out a few trees at a time, no more than can be easily kept moist, as the roots must not be exposed long to the action of the sun and air. Cut back the broken portion of the roots to the sound wood. Why do this? Why perform this extra labor? No one who has had occasion to remove trees a year or two after transplanting will ask this question. On a broken root not cut back as directed there will be found a dead stub, one, two or three inches in length, as the case may be, which will, of course, affect the tree more or less; whereas, if the root has been cut away as directed, a callus will be formed and rootlets thrown out at the edge of the cut, and the whole root will be in a sound, healthy condition.

The top must be pruned. And why? Primarily, to shape the tree, for the shape of an apple tree is of a good deal of importance. Secondly, to restore the balance between the top and roots.

In the growing tree there is a proportion between the roots and branches; if we destroy a large number of roots, as we always do in transplanting trees of much size, this balance is destroyed, and must, to produce the best results, be restored. The larger the tree, the greater the loss of roots, and consequently the more severe must be the cutting back of the top, thereby destroying all the advantage which we expect to obtain from extra sized trees.

After the tree is properly pruned, it is well to wet the roots before setting. This, too, may seem a small matter, but the affairs of life are made up of small matters. By simply wetting the root the fine particles of soil will adhere thereto. The earth can be more closely packed around it, consequently there is less liability to dry up. On this simple process, it seems to me, sometimes depends the life of the tree.

Now, everything being ready, place the tree in the hole upon a small mound, so that the roots will spread out in their natural direction. Then, holding the tree perfectly upright, fill in around it with the richest soil which it is possible to obtain, taking care to place no manure in immediate contact with the roots. I wish to emphasize this point. Use the very best and richest soil which can be obtained; work the soil among the roots so that no space will be left unfilled. Don't be afraid of dirt, but get down on your knees and work with a will. The farmer who is too proud or too lazy to get down upon his knees in setting trees is not fitted for the business of fruit raising. Shake the tree occasionally while filling, and, after the roots are well covered, press the earth firmly down with the feet. The ground should be left a little crowning, so that after settling the tree will stand at the same depth as in the nursery.

After the tree is well set it should be mulched, which is a process of covering the ground for some distance around the tree with straw, leaves, saw-dust, coarse manure, or any material which will keep the ground moist and prevent its drying and baking, and obviate the necessity of watering the newly set trees, which process is of doubtful utility at any time.

It is a principle in natural philosophy that two bodies cannot occupy the same space at the same time; it is also an agricultural fact, susceptible of demonstration, that two crops cannot be grown upon the same soil at the same time without detriment to one or the other, unless plant food sufficient to supply the needs of both is furnished.

In orchard culture the plant food will after a time become reduced by the growth and product of the trees, and must be re-supplied in order to produce full crops. This exhaustion of plant food will be accomplished much sooner if, in addition to the trees, the soil is occupied by grain or grass, two of the worst crops which can be grown among fruit trees. Hence the folly of sowing to grain and seeding down to grass the soil of a newly set orchard. The correct method, it seems to me, is this—to continue the cultivation of the soil with hoed crops and heavy manuring, or to keep the ground entirely clean by the use of the cultivator, dispensing with all crops except the product of the trees, and giving an occasional dressing of manure as the trees require it. In orchard culture it must be remembered that the roots fill the whole surface of the soil. That the small fibrous roots which take up plant food are at a great distance from the body of the tree. Consequently the application of manure about the trunk of the tree can do but little good. Fertilizing material should be applied broadcast over the whole surface, and worked in with the cultivator. In cultivating an orchard, extreme care must be exercised that the roots are not injured by deep plowing, or the bodies of the trees mangled and bruised by the carelessness of the workmen.

Pruning is a portion of the subject upon which there is an almost endless variety of theories and practices. All admit that pruning is necessary. But consult fruit growers, or men who have written upon the subject, and note their replies. The first will tell you to prune any time when your saw is sharp, never when it is dull. This advice has the advantage of being partly right, for we never should prune with a dull saw. The next will tell you that there are fifty-two days in the year on which tree pruning should not be done, viz.: the fifty-two Sundays. One will advise to prune in the fall; another in March; another in June; so that there is probably no month in the year that has not been recommended by somebody as being the the very best time to prune fruit trees, and each has given his reasons. Now in view of all this diversity of practice and contradiction of theory, it is not strange if the novice finds himself in a haze of bewilderment, and from fear that he will go wrong, leaves his pruning entirely undone.

In order to clear up this matter a little, I will give my own method, founded on several years' experience and observation. There are several objects to be attained in pruning. The first which we shall consider is to give the tree its proper form, which is that of an umbrella inverted, with the branches sufficiently spread to give free access to the air and light, which are essential to the full perfection of the fruit. This also being the form which gives the best facilities for gathering the fruit. The young tree may be pruned into this shape when first set, which can then be easily done.

Starting right, then but little pruning will be required at any one time, but this little must be attended to closely, and may be done at any time when the jack-knife is sharp, and consists simply in removing by cutting or rubbing off such shoots as may start up in places where they will not be wanted. If this is done in season, no large limbs need ever be cut, except it may be occasionally to remove a dead one. This kind of pruning may be done at any season of the year, and, theoretically, no implement but the pruning-knife and shears will be required ; but practically, on account of neglect in attending to it in season, the saw may sometimes be necessary, but never upon any occasion, except to cut it down, use a hatchet or an axe about a fruit tree.

Different varieties of apples have different habits of growth, and in order to prune intelligently and preserve each tree in its proper shape, some knowledge of these different habits is necessary.

Let us now give our attention to an orchard that has been thoroughly neglected, that has been allowed to stand in the grass with no care whatever, the ground having been cropped every year and nothing returned, the trees being left entirely free to make what little growth they could in their own way until each tree is nothing but a mass of moss, rough bark, tangled brush and dead limbs. This is no fancy sketch. There are hundreds of just such orchards all over the country, and the treatment which they require is what the surgeons would call heroic, both as regards pruning the trees and cultivating the soil. As regards time of pruning, any time would prove better than no time—better prune any month in the year than let it remain in its present condition. In managing such an orchard I should prune either in November or in midsummer, at the time the new wood is forming, when the wounds will soon heal up, doing the tree but little injury. Would never prune in early spring, at the time growth first commences, for the reason that the cut does not heal over readily, soon decays, leaving an unsightly wound, and because pruning done in the season of rapid growth tends to check the vitality of the tree. Writers object to pruning at this season of the year because of the flow of sap, but my own observation has led me to mistrust this idea, and I am of the opinion that the flow of dark, unhealthy sap that we often see, causing a black, cankerous stripe wherever it touches, is due more to the condition of the tree than to the time of pruning. I would, in connection with the pruning, plow the soil, turning a light furrow, apply a liberal amount of fertilizing material and then proceed as recommended with a newly set orchard.

Pruning should be done wlth a sharp knife or saw, leaving a clean, smooth cut. At the juncture of the branch with the trunk of the tree or with a larger branch there is a small projection or shoulder; cut as near as possible on a level with the limb pruned from, and at the shoulder; if a stub is left it will never heal and suckers will start, thereby defeating the object of pruning. On the other hand, if the limb is cut too close, it will leave a large wound difficult to heal.

There is sometimes a diseased condition of the body of the apple tree, and which usually destroys the whole tree, caused by the sun's rays striking the exposed trunk. This is obviated by such training as will cause the body of the tree to be shaded by the foliage.

There is another class of trees which demand a moment's attention—those which have come up of themselves in the fields and pastures. They have been neglected, perhaps, and are rough and scraggy; but, at the same time, many of them are hardy and healthy, and, wherever this is the case, first class trees can be made of them and good fruit obtained much sooner than can be obtained from such as are set from the nursery. The owner of such trees should lose no time in causing them to be grafted. If the trees are of bearing size and the work well done three years will be sufficient to give him a good crop of fruit. The proper method with such trees is to graft the whole tree at one time—and any healthy grafted tree which is a shy bearer or which produces inferior fruit may be treated in the same way. Some recommend grafting but a portion of the tree at once, and consequently being two or three years in going through the whole. If the work is done as it should be, care being taken to graft none but small limbs, none more than one inch in diameter, the work can safely be all done the same year. No pruning more than is necessary to do the grafting should be done at this time.

The sprouts which start around the scion should be rubbed off during the summer, but no other pruning should be done until fall, when about one-half the remaining natural branches should be taken out, and the remaining one-half allowed to grow another season, when the whole may be taken away, leaving the scions in sole possession. Many procure their grafting done, and neglect the absolutely necessary after pruning until the natural growth has completely choked and starved out the scions, rendering the work of grafting of no avail.

VARIETIES.—In the selection of varieties, choose only those which are adapted to the locality. It is one of the sins which tree peddlers will have to answer for, that they have been crowding upon the people a great many varieties which can never be made profitable.

In raising apples for market the fewer varieties grown the better, and in the selection of those varieties be guided by the experience of the most successful fruit growers in the immediate vicinity rather than by the picture books of tree agents. The distance of but a few miles will sometimes change a variety from a heavy bearer to just the reverse, so that it is impossible to give a list suitable for general cultivation. For my own locality the Baldwin is far the most profitable market variety which can be grown. With my present experience I should next choose the Hubbardston

Nonesuch. The Rhode Island Greening, in many localities, is a profitable variety, but with us is rather a shy bearer, and should plant but sparingly for market.

For those who are near a large village which affords a home market, the selection of varieties will vary from those who must depend upon a distant market—the latter must raise winter apples almost wholly, while the former may devote more space to earlier varieties.

For home use a greater variety is needed, and should be so selected as to insure a full supply of apples from the very earliest to the latest. For this purpose would recommend, first, the Red Astrachan. This is one of the handsomest of apples, an upright grower, vigorous and very productive. The Early Harvest is also a very fine variety. William's Favorite is a very good apple, the tree said to be hardy and productive. The Sweet Bough may be set for an early sweet apple. These four varieties or their equivalent will be found sufficient for early summer use.

Next in order comes the Garden Royal, than which in its season no better apple grows. Next, the Porter, which should be mainly relied on as an autumn variety, as it is a great bearer and the fruit of first rate quality. The Fameuse is a popular variety, coming to maturity a little later than the Porter, very hardy and adapted to cold localities, doing well where other varieties would die. The next in order would be the Twenty Ounce, or, as it is called with us, the Blessing, a large late fall or early winter variety, productive and valuable for cooking. Next in order of time of ripening is the Hubbardston Nonesuch, a first rate fruit, which can be recommended for both home and the market. Next in order would come the Baldwin, then the Rhode Island Greening, and close the succession with the Northern Spy. This last is a fine variety, retaining its fine flavor to the last, but is very tender skinned and must be handled with extreme care or it will soon decay. The tree requires considerable age before coming into bearing.

A good supply of sweet apples is also desirable. The following varieties will make a succession, viz : Sweet Bough, Golden Sweet, Bemis Sweet, Pound Sweet, Sweet Russet, Tolman Sweeting and Ladies' Sweet.

The foregoing list gives a good succession of both sweet and sour apples, but can be varied to suit the locality or the taste of the fruit grower.

As a late keeper some might recommend the Roxbury Russet in place of the Northern Spy, but the Russet is a very shy bearer and lacks quality, the flavor, I should judge, being something like that of dried pumpkin soaked in poor vinegar.

The Yellow Belleflower is an excellent variety, but in many localities utterly refuses to make itself profitable, and so of very many of the best flavored varieties.

HORTICULTURE AND FRUIT RAISING.

BY E. E. ANDREWS, OF BERLIN.

To talk pleasantly upon this subject may be quite easy, but to write profoundly is far more difficult, and to thoroughly succeed in impressing the hearts of the multitude with the utility of horticulture, would require far greater experience than most of us possess. The most I can hope to do is to stimulate others to do better than I have done—others who not only recognize nature's laws but also the ability of man to co-operate with Him whose right it is to establish law.

In the beginning, when God had created all things, and after pronouncing all that He had made "very good," He gave man dominion over all that He had made, and placed him in a beautiful garden called Eden, (not in Northern Vermont but farther East,) to *dress* and *keep* it. The first and only place, at that time, where horticulture had been introduced by the Great Husbandman. I speak of this merely to show the utility of this noble calling, and the necessity of rendering assistance to nature's laws in the greater development of her resources. And had God intended that nature should have perfected her own work without the aid of man, then had Adam been thrown out of employment and lost his titled honor of both keeper and cultivator

I have sometimes been amused at the novel idea suggested by some of our farmers of the impropriety of pruning, shaping or fashioning our fruit or ornamental trees, for fear we should rob nature of her high privilege of adorning herself in her own style and beauty. And to adhere strictly to these false notions, not of unfrequent occurrence, would be to divest man of reason and sound common sense, the very endowed elements of our nature. To leave the plant unaided by the help of man, to be controlled only by nature's laws, would be to allow its deformity to become obnoxious to man, as well as to Him who established these laws.

With equal propriety might we leave the children of our care to their own inclinations, without proper training, with the view that God created them and therefore we must not meddle with His works, lest we be found sinning against Him by undertaking the task of finishing up that which He had left incomplete. But we take a broader and a more elevated view of God's creation, and believe He had a wise and holy purpose in the formation of man, to be placed here to assist nature in carrying out these fundamental principles that underlie all hope of success, both in the vegetable and animal kingdoms.

Allowing the above suggestions to be true, man by compulsion is thrown under weighty responsibility for the faithful discharge of his duty, not only for a thorough cultivation and training of his offspring in his own house, but for a thorough cultivation and training of both plant and tree; the latter of which, if properly done, will not only beautify the home of every laboring man, but will furnish food and nourishment for the indwellers of every home circle throughout Vermont and the wide world. Nevertheless it is astonishing to every experienced person, that so little attention is paid to this important branch of agriculture. To say nothing of the profits to be derived from the horticultural department, there is an untold satisfaction in the propagation and cultivation of fruit and flowers that makes them attractive, and adds much to the happiness of the domestic circle. For want of adaptation but very few among our farmers become experts in the horticultural department of labor; and yet among the vast many who pay but little attention to this important branch, there are some even whose taste and skill would be fully adequate to such a position, were it not for the hard pressure of business in other departments of agriculture.

And here, in my opinion, comes in one of the grand mistakes to which farmers subject themselves; for of all the crops that farmers raise upon their farms, let fruits of the choicest varieties be the last to be neglected. For no crop, in my opinion, among those that furnish food, is more remunerative to the common farmer than well selected and well cuitlvated fruit. Furthermore, it is conceded on all hands, and especially are physicians agreed that among the various products of the farm, none are more healthy or more nutritious than the fruits we raise. And among the fruits the apple takes the first rank. It is said by good authority that the apple contains a larger amount of phosphorus than any other of the ordinary fruits or vegetables, and as this is one of the most important elements in the nourishment of the brain, and especially necessary to those who work with the brain, the habitual use of apples as an article of food is greatly to be recommended. Another substance so desirable to promote health, found in the apple, is the acid it contains valuable to rouse the liver from its sluggish condition.

Thus, while the brain is the all important organ with those who are known as great thinkers, it is of the first importance to this class to make use of all the means within their power to preserve in health and vigor this essential organ. Therefore fresh fruits, of the several kinds which are adapted to our climate and locality, and which can be so easily and so readily raised by the farmers of Vermont, should constitute an important element in the daily fare of all mankind. And we believe it to be within the means of nineteen-twentieths of all the farmers in Vermont to raise the necessary amount of fruit for home consumption, with scarcely the slightest embarrassment.

A few hints in regard to the variety of fruit and the manner of cultivation may be in place. The selection of trees may be varied according to locality. And here, let me state, comes in one of the greatest mistakes among orchardists, as well as among our common farmers, and which has had a tendency to weaken, if not to destroy the confidence of the majority of farmers throughout Vermont. They have been so frequently imposed upon by fruit tree venders, that their courage is nearly exhausted. By those agents whose mission it is to coin as many dollars as possible, with the least expense to themselves, many varieties have been introduced which are as useless to the farmer, here in Central Vermont, as June bugs are to a winter squash, or the modern pest to the success of the currant. How few among the vast number of farmers in the United States but would be exceedingly glad if they could easily raise sufficient fruit for the consumption of their own families. And who among this vast number may not, with due prudence in selection and proper cultivation of the trees, succeed in thus doing? I am sanguine in the opinion that there are few who may not. I have in my own orchard the following varieties: Rhode Island Greening, Jewett's Red, Baldwin, Jewett's Best, Roxbury Russet, Blue Pearmain, Ben Davis, Andrew's Favorite, Northern Spy, Bethel, Fameuse, Red Astrachan, Porter, Sops of Wine, Gordon Apple, Winter Pippin, Tolman Sweet, Hayward Russet, Honey Sweet, Hampshire Sweet, Foundling, Twenty Ounce, Munson Sweet, Northern Sweet, King of Tompkins County, Calvert, Keswick Codlin, Fall Pippin, Early Harvest, Belleflower, Golden Russet, Gravenstein, Tetofsky, Duchess of Oldenburgh, Haas, Wolf River, Alexander or Emperor and Pewakee. I have several other seedling varieties that originated on my own farm, some of excellent flavor and good bearers, which I will not mention here. Among the above named varieties, there are but few that I would recommend to our Vermont farmers. The Rhode Island Greening and the Baldwin are classed among our choice varieties, and while I have some very fine trees of those kinds, I have some that show signs of decay, and the opinion is quite general that farmers in Central Vermont as well as in the Northern part, cannot successfully grow those varieties. The Blue Pearmain is a good bearer; the fruit is handsome and very pleasant; it is a late keeper and the tree is hardy; it is not quite tart enough to suit all tastes, but with some it is a great favorite. The Jewett's Best is a good variety of winter apple, a good grower, and a medium bearer.

The Ben Davis is a fine winter apple; good size, constant bearer; the tree not a rapid grower but apparently hardy. The Northern Spy is a winter variety; fruit excellent, tree handsome and hardy; but in order to enjoy the fruit one wants to live to a good old age, unless he should be so fortunate as to inherit the property of a past generation. I would not, however, discourage our farmers in setting two or three trees of this variety, for if they do not live to enjoy the fruit themselves, it is barely possible that they might leave grand-children to enjoy it after them. The Bethel is a fine winter variety, much resembling the Blue Pearmain in shape and color, and, though more tart, it would suit more tastes than the former. The tree is a fine grower and hardy. The Fameuse is a late fall or early winter variety, and is one of the finest and most profitable apples raised in Central Vermont. The fruit is handsome, deep red splashed with green; a constant bearer and hardy. The Red Astrachan is an early fall variety, and forms a handsome top. The fruit is handsome, rather tart but fine flavored, and the tree hardy. The Porter should occupy a prominent position among the choice varieties. With me this tree is hardy, the fruit excellent in flavor, straw color, of good size, is a good bearer, and on the whole is a fine marketable fruit. The Sops of Wine is an early variety, ripening in August, of fair size, reddish color, not very tart nor very juicy, a good bearer and hardy. The Tolman Sweet is a winter variety, good keeper, fruit of a greenish color, medium size, good quality, a constant bearer, and should be found on every farm in Vermont. The Honey Sweet is a seedling variety, originated on my own farm. It is one of the sweetest apples that grow, of medium size, a constant bearer, and wins favor with all lovers of sweet apples; the tree is hardy. There are none in the market for sale, but should be both for luxury and profit. The Munson Sweet is a very fine apple, of medium size, straw color, a great bearer; the tree apparently hardy and profitable for this locality. The Tetofsky and Duchess of Oldenburgh are fall varieties, and are in good repute. I cannot speak from experience, as my trees of these varieties have not yet come into bearing. The Haas, Wolf River, Alexander and Pewakee are Western varieties, sent to me from Wisconsin, with the highest recommendations as regards quality of fruit, their keeping quality, and the hardiness of the tree. They have proved themselves, thus far, fine growers, and with the high recommendations with which they come to me, I intend to grow them for the market. I would say, however, that the Alexander or Emperor has not so fine a flavor as some other varieties, but is termed the king of apples on account of its size. It is said to be a good bearer and hardy. The Andrew's Favorite, a seedling originating on my own farm, is among the handsomest if not the handsomest of the apple family, and of the finest flavor. In regard to the hardiness of the tree, I have only to say that my father (who is now living on the old farm,) says he helped set the orchard when he was fifteen years old, and he was eighty-eight last May, making the old tree seventy-three years of age where it now stands hale and hearty, and bids fair to celebrate its centennial, with but few of its companions. A friend of mine, in

Northfield, says he remembers distinctly of eating fruit from it over sixty years ago. My young trees are very hardy. All this speaks much in favor of this variety. A fruit grower in Wisconsin to whom I sent a few samples of the fruit wrote me thus:

"I suppose you are anxious to know all about the Andrew's Favorite. I remember you wrote me that it would keep well until January, but I shall set it down as a late keeper, for I kept one of those you sent me until yesterday, April 21, and it had retained its flavor beautifully."

In regard to the crab varieties I am sorry to say that a great many of our farmers have been deceived, and those that have more than one tree have got too many, and those that have not one have not enough. Every farmer should be the owner of one good Transcendent Crab, and as they are constant bearers it would furnish a supply for any family of ordinary size. The Hyslop was highly recommended but a few years ago, and is one of the handsomest crabs that grow, but is not worth harvesting when grown.

In regard to the cultivation of fruit, much has been said and more written. Nevertheless, there are many foolish notions still existing among our farmers in regard to this matter. Lest I weary your patience, I will endeavor to be brief in stating my views in regard to it. The plat of ground on which to set your orchard demands careful consideration, and either extreme of too dry or too wet should be avoided. For the good of the tree the ground should be heavily manured, plowed and cultivated certainly two years before your trees are set, thoroughly and deeply working the soil each year, allowing your manure to entirely decompose in the soil, thus causing no injury to the young roots of the trees. In choosing your trees I think you would be well paid, when it is convenient to do so, to visit the nursery from which they are to be taken, selecting none others than your experience has taught you are both hardy and productive, and when you see a tree of two summers' growth that stands superior to those of its companions of the same age, that is the tree for you, as you may be assured that its root is healthy.

In regard to the distance we should set our trees from each other, I find a great diversity of opinion. But my views are to set them about twenty feet apart each way, giving the limbs a chance to expand ten feet in each direction, before coming in contact with each other, which will give a very fine top. I would encourage the cultivation of the soil but very few years, say five or six at the most, with due caution never to get too near the young tree with the plow or cultivator; but let the soil near the tree be stirred with the hoe. At the age of five or six years I would seed the land, but continue to keep the soil loose near the tree for a space of five feet in diameter until the trees are old enough to bear fruit.

In setting the tree much care should be observed in opening a space sufficiently large and deep so as not to cramp the root of the tree, but give it plenty of room, so that each root shall occupy its natural position in the soil, taking particular pains that the fibrous roots are not laid in a mass together. I think it a fine thing to use all the waste bones at hand, placing them at the extremities of the roots. Oyster shells may be used with equal propriety, all these having a tendency to keep the soil loose and to furnish food for the trees. Never put manure about the roots of your trees when setting, unless you mean to kill them. Bring in your finely pulverized soil carefully among the fibrous roots, leaving your tree a trifle lower in the soil than where it stood before, and never mass a pile of dirt up around the trunk of your tree, as some have recommended, until they can tell you wherein lies the benefit, and be sure you understand their philosophy.

Allow me to say just here that, in my opinion, as a preventive against mice no remedy is more sure than thoroughly treading the snow about your trees, especially if the ground is frozen. Other applications, such as are often recommended, like staves or tarred paper tied around the tree just above the ground may be good, but are attended with greater expense and labor.

After your trees are properly set you will find it no loss of money and but little of time to use all your waste suds about your young trees. It contains more or less alkali, one of the best ingredients for tree nourishment, in my view. And I would also recommend, as I have previously done, the washing of young trees from the ground as far up into the limbs as can be done without injury to them. Let the wash be one quart of soft soap to five or six quarts of water, applied with a coarse cloth, rubbing the body of the tree sufficiently hard to remove every particle of scurf or moss from the bark, which you will find to give the tree a beautiful green appearance, and looking as though you had given it a coat of varnish. It certainly does no injury to the tree, and I am quite sure is a benefit, as also a preventive to the pests that infest our orchards.

A few words in regard to the training and pruning of our trees. Let this be a study from the time of setting to the time of fruiting, for, among all the mistakes to which we as farmers are subjected, none seem to me more sad than the want of sound discretion in the proper heading of our trees. In the first place, let us consider how high we would head our trees. I am very much in favor of low limbing. I would never limb or head a tree more than two and one-half feet from the ground, and would, under ordinary circumstances, head them two feet instead of more. My reasons are that low limbing protects the body of the tree from the sun and renders it much more convenient for gathering the fruit, while the fruit is less liable to injury from bruising.

To shape the head of your tree, follow upon the spiral stock to the height you would wish the head to start, and with a sharp knife cut from the opposite side of the bud from which you wish to start the upper limb of your tree, slanting the knife upward, making a smooth gash near the bud. Then allow three or four buds to grow, to make the proportion of the tree to correspond with your own taste, nipping all other buds in their early start. We should allow our imagination to carry us on in the progress of our trees for several years. Then, starting with the three or four branches, as above named, we may easily watch their progress, and when, as they naturally will, a bud puts forth in the formation of a limb that, in our imagination, will interfere with a well balanced head in future years, we should be sure to remove it at once with a sharp knife, cutting closely to the limb from which it starts. And in case two limbs should be inclined to come in contact with each other and you wish to turn one of them in an opposite direction to fill a vacancy in your tree, you will please follow up on the one you wish to have change its course, and when you get to the spot where you would like the change to be made, after finding a bud on the side next the open space, place the knife, as before, on the opposite side and cut with a slant toward the end of the limb.

Thus watching every progress of all the branches you may form a shapely head and fashion it according to your own fancy, taking particular pains to leave the centre of the tree sufficiently open to admit the sunlight and the dew. With proper care from the early start of your tree up to the time of fruiting, you may avoid the necessity of cutting large limbs from the tree, for there will be none to cut.

But, where trees have been neglected, as they too often are, it becomes necessary to prune and cut away large limbs. In which case use a fine saw, after which smooth with a knife, and apply soft wax, if you are choice of your tree, to the wounded part, thus preserving the wood and causing the new growth to heal over smoothly, leaving but a small scar. Never use pruning shears in any case, for it is impossible to make a smooth cut with them on a limb of any size, but they will invariably leave the limb shattered and rough.

I would like to say much upon the cultivation of other fruits. A few words, however, and I close. I am of the opinion that pear culture in Central and Northern Vermont can not be attended with profit. Only for the satisfaction of growing them would I ever recommend their culture in this locality. And the same opinion of the grape. This class of fruit can be bought in market much cheaper than we can raise it. If our farmers could manage to devote a little more time to the raising of the several kinds of garden fruits it would add very much to their enjoyment,and also to their health, and I am inclined to think it could be attended to without financial loss. The strawberry, which affords a luxury for every man's table, is within the means of all or nearly all. The raspberry, so freely grown by nature upon nearly all our farms, hardly need be cultivated by us. The blackberry may be successfully grown from our common variety, and will thrive much better by cultivation than in its natural state, and requires but small amount of labor.

In conclusion, let me urge upon all farmers in Vermont the necessity of beautifying and endearing the old familiar spot—dearest of all on earth—home, with those luxuries that shall enable our children and our children's children to look back with profound gratitude, and bless and reverence the day that gave them birth in a land of fruit and flowers.

RURAL ARCHITECTURE.

FARM BUILDINGS.

BY HENRY SAFFORD, OF QUECHEE.

The high nature of man was, as declared by the Psalmist, "created but a little lower than the angels, and crowned with glory and honor." As distinguished from the brute, he has a will and mind to control the nature of his surroundings, and is, in a sense, sovereign of his own destiny, and has resting upon him the high command to subdue even the earth.

How must a man rise in his own dignity who feels himself intrusted with such responsibilities! No mean shed, barely sufficient to cover himself and family from the storms and the extremes of heat and cold, will answer his high condition. The language of the Bible exhausts itself in its attempts to portray what has been done for the soul. "Eye hath not seen nor ear heard," is its language. "In my Father's house are many mansions. I go to prepare a place for you." If, then, so much has been done for the soul, surely something should be done for the body. The farmer is not confined to some little strip of land like the denizens of our cities or villages, not large enough for our door-yard, and whose utmost limits are counted by the foot. Our motto may be that of the old warrior:

> " No pent-up Utica contracts our powers,
> The whole boundless continent is ours."

The house should be located, like Burns' Montgomery, " Where summer first unfolds her charms, and where she longest tarries." While we think of it, can there be a more desirable situation than a family thus located? Perhaps the place made sacred by its having been the residence of " parents passed into the skies." In a country where each man can own his own farm and till the farm that he owns it cannot be expected that his buildings will be as pretentious as those of the lord with inherited possessions too large for his own inspection even. The house should be located as near, the center of the farm as circumstances will admit. A given amount of room can be more cheaply had in a two story, upright house than in any other form. Many reasons could be given in favor of the two story, upright house. First, the chambers are more desirable in summer. The attic is a protection from the scorching heat of the sun, and in winter, the roof, being at a greater distance from the more heated parts of the house, is not troubled with the snow melting and again freezing at the eaves, forming a dam to turn the water back again into the house. How many houses have been half ruined in this way, to say nothing about inconvenience and vexation.

The rooms most in use should be in the sunniest and most pleasant part of the house. The kitchen should have every convenience that modern ingenuity can suggest; just large enough in which to do the work of the place but not large enough for a dining table, and furnished with an abundance of good water. Adjoining the kitchen should be a roomy dining room, and opening into this should be a sitting (or living) room, furnished with a good library, and as many papers as the family can read and not neglect the books, with a well winnowed selection of the literature of the day. Do you say this is too much? Only think of the rainy days and the long winter evenings.

If a dairy is to be the leading interest, a milk house, separate from every room of the house (except the ice house), should be attached on the shady side; and if for butter, the large pans are indispensable, if for no more than eight cows, such is the economy of labor. In a paper of this kind, every convenience and appendage of a farm house cannot be enumerated, but the deep gravelled or brick walk, the projecting veranda, and the portico should not be forgotten, nor the spacious yard, giving room for the flowers and shrubbery.

Connected with the house should be the most perfect drainage. It is a reproach to the country and a burning shame that typhoid fevers (more to be feared than the yellow fever of the South because more fatal,) are so frequent, and it is a recognized fact that the more perfect drainage of our cities throws the percentage of fevers against the country; and when our dear ones are stricken down from this cause, how impious to charge it to a mysterious Providence who gives us all the broad heaven with its free air!

Pages could be written upon this subject, but I must turn to the other adjunct of the farm,—the barn, and I will say in the start that in no case should this be joined to the house for reasons above mentioned, and for greater security against fire. What is a constant stream of tainted air to a few steps and a free view? As much thought and skill should be bestowed upon the barn as the house. Horace Greeley once said that his stone barn at Chappaqua, which he had built, would speak of him when all else he had done would be silent.

In this, like the house, greater economy of room and convenience can be had in one large upright structure than in many smaller ones. If possible, I would locate it by a bank that could be made available for a drive-way for taking hay and fodder to the loft above the beams. In our crowded hay season and with labor expensive, such is the economy of labor in mowing that it amounts to days in a single season. I would have the sides tightly boarded, and the stables large enough that every thing that walks on four legs about the building may find shelter beneath its roof How much is lost in growth of stock and in food, in our Northern latitude, for want of warm shelter!

I think it pays (and I speak from demonstration,) to lay brick edge-wise in mortar entirely around the stables, so that the animal heat from the stock will prevent freezing, even in the coldest weather. This is consistent with the best ventilation. I much prefer the wooden stanchion to any other method of fastening. A platform, four feet six inches long for large cows, two inches shorter for smaller ones, a drop of six inches, a trench sixteen inches wide, and a walk elevated two inches, with sawdust, dry muck, or even clean sand, every whit, both of liquid and solid manure can be saved, and you will have pure air, sweet milk, and a clean stable.

Opening from the stables should be a root cellar. This, too, can be made proof against frost by a double brick wall, leaving an air space of two inches between the two walls. The inner wall, like the lining of the stables, may be made with the brick edge-wise. No farmer can afford to raise young stock or keep milch cows without an abundance of roots. I speak from twenty years' experience in root raising. Under the stables should be a cellar, or, for want of this, a lean-to or shed, for storing manure. The horse stable and piggery should be in close proximity. In a recent discussion, in our county, upon the wastes of the farm, was enumerated with great truth the heating of horse manure. This can be wholly prevented by using this manure, with its accompanying litter, as an absorbent in the pig-pen, with its stone floor, and thus a fertilizer, containing nearly as much ammonia as the famous Peruvian guano, can be made at home at little cost except in the arrangement of our buildings. Every yard should have its water.

Somewhere in the barn should be a place assigned for grain that is to be threshed, and in the floor beside it a place for a thresher, propelled by horse power, and a loft beyond for straw. No one but those who have tried it knows how much can be gained by threshing before husking, so that the straw can be used in alternate layers with the corn fodder; thus one can be saved in good condition, and the other doubled in value for feeding purposes. Even the tops of turnips and mangels can be preserved in this way, to be fed out in the winter, to our sheep and young stock. As is the case with the house so with the barns. All the conveniences for cattle and sheep pens, for shelter for tools, carts, &c., cannot be enumerated here. I am quite well aware that we all, to some extent, are supplied with buildings, and it is not the purpose of this paper to advise the plan of the individual of unenviable notoriety in Scripture, to "pull down and build greater," but as our buildings are constantly needing repairs, and the increased fertility of our farms demands additional room, can we not, as those changes are required, approximate to our ideal of what a farm home should be? Who of us, as we have visited our large cities, and have viewed with admiration, mingled with a feeling of not so gentle a name, the splendor obtained by the unequal traffic with the country, have not asked ourselves, have we of the country retained and appropriated for ourselves and our children, our share of the elegancies and comforts of this life? "The fault, dear Brutus, is not in our stars, but in our selves that we are underlings." And since the raid for the West has spent itself, shall we not seek to make our homes all that is implied in that word *home?* As it is said that man should be judged by the condition in which he is found, so let it be with us. "Agriculture," says Washington, "is the most healthful, most useful, most ennobling occupation of man." Brother farmers, let us magnify our calling by surrounding it with all the attractions that lay in our power.

GENERAL AGRICULTURE.

ENGLISH FARMING.

BY WILLIAM S. THORP, OF UNDERHILL.

MR. CHAIRMAN :

In attempting to give a little sketch in relation to English farming, I feel my inability to do justice to the subject, as the occupation of farming, with its different branches, would be matter enough to fill a large volume ; likewise, it might be very tedious to you to listen to all the details, but please have patience, and I will cut it as short as I can to give you a tolerable understanding of the matter.

Agriculture is the art of cultivating the earth. When our first parents committed the act of disobedience which brought sin and death into the world, they were sent forth from the Garden of Eden to till the ground from which they had arisen, and it was cursed on their account to bring forth thorns and thistles, and Adam was told that he should only eat his bread by the sweat of his face ; but so good is God, though he does not suffer the ground to yield us bread without our labor, he always gives us bread if we labor for it. Our first parents, when driven from Eden, naturally chose a fertile soil and genial climate, but as their descendants multiplied they were obliged to seek new countries, and, leaving the warmer regions of the South, gradually made their way into the colder and less fertile countries of Northern Europe, which were, therefore, late in receiving any knowledge of agriculture.

Husbandry came from Egypt to Greece, and from Greece to Italy, and thence it made its way into the British Islands, in some parts of which it has been brought to far greater perfection than it had ever reached in the more favored lands of the South.

When the Romans conquered England the inhabitants in the interior, who were savage and clothed in skins, lived in the woods with which the country was covered. In fact, husbandry was unknown in the inner parts of the island, though grain was grown toward the coast. The most civilized were the inhabitants of Kent.

After the departure of the Romans from the island, and the establishment of Christianity, about the year 595, agriculture made considerable progress, as the monks, who understood the Latin language, read the Roman authorities and taught their servants and tenants husbandry as far as it was then known. At this time the rude plow and harrow, when used, were always fastened to the tails of either oxen or horses, the driver walking backwards, facing the team and flourishing a cudgel—a very odd way of encouraging the team to follow him!

The Normans, after the conquest of England in 1066, introduced the wheel plow; but, being more given to hunting than to husbandry, they very greatly prevented the cultivation of the soil by keeping large tracts of country as preserves for game; the forest laws were very severe, the punishment for killing a deer being death—the same as that for killing a man. The peasantry were slaves themselves, their children and goods all belonged to the lord of the soil, and most of the lands were granted to the nobles or the church.

During the latter part of the dark ages, as they were called, (from the eleventh to the fifteenth century,) but little is known of British husbandry. Printing was not brought into use until about the year of 1435, and it was not until nearly a century after that any book of note was printed on agriculture. In was about the time of the reign of Henry VIII. that the cabbage, carrot, turnip, artichoke and some other vegetables were brought into England. It was during the reign of Elizabeth that the potato was introduced into Europe by Sir Walter Raleigh. Nearly a century had passed before it could be said that it was generally cultivated in England.

England at that time was very backward in agriculture. Now she is famed for the excellence of her clover and turnips, which were introduced in the sixteenth century. This is the time from which England dates her prosperity as an agricultural nation; and, however proficient she might have believed herself at that time in raising the grains and grasses, she no doubt looks back to those days with wonder and astonishment, and realizes how rude and imperfect were her ways of farming at that time.

After the introduction from Flanders of the clover and turnip, it was many long, weary years of experiment before it was an admitted fact and success; even at that time their worth was not fully understood.

During the long time that has intervened her population has increased very rapidly, and it has become absolutely necessary for the agriculturists to conduct the management of their farms in such a way as to realize the greatest quantities of bread stuffs and meat from the number of acres under improvement.

The whole number of acres in England amounts to thirty-two and one-half millions—this includes all of her waste land and everything; and when we consider her population, amounting to over twenty-two millions, with all their building sites, roads, fences, etc., it must reduce the number of acres for agricultural purposes very materially.

Before the introduction of clover and turnips, it was thought necessary to let their best lands lie idle every fourth year and the poorer lands every third year, or, in other words, they summer-fallowed their lands; in either case there was no crop raised one-fourth or more of the time. This rest or fallow made it a question of very serious consideration with their dense population. Even since my own remembrance a few old-fashioned farmers have followed the old plan, but progressive farmers have seen that by fallowing their lands until about the 10th or 20th of June, the season for sowing turnips and other roots generally, they could raise a crop of roots the same year, thus raising four crops in four years, instead of three crops in the same time, as by the old rule. This was considered a great improvement, and may be called the commencement of the science of rotation of crops.

The agriculturist had been convinced previous to this of the worth of the turnip and other roots; he had raised them in small quantities, but to raise them by acres, and to see the result in the greatly increased number of cattle he was able to keep, the much larger quantities of better manure, and the effect it had on his farm and the returns, he was astonished. He has estimated lands that were suitable for the raising of these crops to be worth double in price on that account.

Before I attempt to say anything in regard to the rotation of crops, I will say that their grass lands are always in grass when once seeded down; the climate or soil or both are so favorable to the growth of grass that the sod improves from year to year, forever, for aught I know to the contrary, consequently the grass crop is not taken into account in farming on a rotation.

It is a well known fact that all plants do not consume the same properties from the land for their support. One plant will consume for its development that which another will refuse; a soil that has produced one crop for a number of years will become exhausted in the elements required for the production of that crop—consequently rotation gives a greater variety of crops.

The first crop in the rotation is roots, mostly turnips, either the rutabaga or common flat English. Potatoes are only raised for the table, and, as two hundred bushels are considered a a large crop per acre, they cannot be raised for feeding purposes

RAISING ROOTS.—The manner of preparing the ground for roots is to plow five or six times over between the last of April and the time to put in the seed. At each plowing the ground is rolled and harrowed and every weed or root of any description is picked off by hand, and either drawn off into a compost heap or else burned in a pile. The seed is drilled on ridges mostly, about twenty-three inches apart, hoed twice and thinned, leaving plants ten or twelve inches apart. The manure generally used is common barnyard manure, well rotted, and phosphates. The season being favorable, thirty-five or forty tons of roots to the acre will be produced, which are usually fed on the ground where raised. This is done by using a movable fence, and fencing off a patch in proportion to the size of the stock in the field, the climate being favorable enough to allow cattle and sheep to be kept in the field all winter without shelter, and with nothing for feed save roots.

The large amount of droppings that would be occasioned by a good crop of roots, and they being most soluble, leave the land in a very good condition for another crop, which on their best lands is generally barley, which is raised for feeding purposes and the manufacture of English ale. On their clayey grounds this crop is generally oats, but in other cases the ground is stocked down with red clover, if the owner wishes to cut it for fodder; but if he wishes to pasture it the next season, he stocks it down with white clover and a mixture of some other grasses. In either case, whether he cuts it for fodder or pastures it in the fall, it is plowed and sown with wheat for the fourth crop. Then comes the second round of the rotation again.

It will be seen that by fallowing the ground and by plowing five or six times, with a good harrowing at each plowing, a good coat of manure and phosphates drilled in with the seed, the land is in good order for the root crop.

The turnip, as is well known, has a very large and succulent top in comparison to the root, therefore it draws the larger portion of its support from the atmosphere, consequently a smaller portion from the ground. It is a crop which reduces the qualities of the soil but very little.

You will have noticed the crop following to have been barley stocked with clover. The clover crop is second only to the turnip in keeping up the fertility of the soil—indeed, I do not know but is equally as good and important in many respects. The plant, being of peculiar construction, also draws a large portion of its support from the atmosphere; and, having a long tap root, it descends deep into the ground, far into the subsoil, even to the depth of two or three feet, much deeper than most other plants; consequently, is nourished by plant food that would otherwise be out of the reach of some other crops. Something is here gained that would not be available were it not for the peculiarity of its root.

In following this rotation the agriculturist knows well that if he can raise a good crop of roots the rest of the rotation is very sure.

This rotation has done so much for English farmers, in increasing the fertility of the soil and also the amount of meat, that they have gradually increased the number of acres devoted to the root crop.

But still they had two qualities of land remaining which they thought it was impossible to produce turnips on. One was a light sandy soil that had but little compactness; but, by working the ground earlier in the season and by sowing the seed before the soil became too dry, they could produce a crop. Nor was this all. This class of soil was considered too light for grain, but by consuming the crop of roots on the surface of the land where raised, with the continual treading of the sheep upon it during the winter months, the soil became heavy and compact enough to produce crops of grain abundantly the following year. This again stocked with clover, to be consumed on the surface by sheep, keeps the land in such a state of compactness that this quality of land rents for twice the amount since the introduction of the turnip and clover.

But they had another class of soil that was entirely unsuitable to grow either turnips or clover, and these soils were cold, stiff clay. This was the kind of soil they had to fallow every third year, as I have mentioned above.

About this time the question of drainage began to be discussed, and the experiments made proved successful. I well remember the first field that was drained in the township where I lived while a boy; and three years ago, when I was there, I was told there was scarcely a field in the whole town that had not be drained. I remembered two fields which I helped to drain myself, and I went to examine the outlet, and they were pouring out the water with as large a stream as they had thirty-five years before. These two fields, before being drained, consisted of strong blue clay, but now the soil is more like loam, and quite friable, easily crumbling with the pressure of the thumb and finger. So, by draining, these soils have been brought within the four years' rotation.

And here comes in a very important use of clover again. The long tap roots penetrating through the hard, stiff clay down almost as low as the drains, decay, and leave an opening formed by the root, which serves as a conductor from the surface of the ground down to the drain, both for the water to leave the surface and likewise for the air to penetrate the soil, which is very essential for the improvement of the soil.

The clover root contains a very large amount of nitrogen; consequently the land, by being stocked with clover every fourth year, becomes porous, friable and comparatively full of nitrogenous and vegetable matter, enhancing the value of such land one hundred per cent.

The next thing of importance in connection with rotation is the art of plowing. The main object in plowing is to pulverize the ground and make it suitable for the reception of another crop. The first general requisite is to plow true and straight. The former is done by knowing how to gauge the plow, the latter by practice.

Plowing.—In plowing common soils, the plow is gauged to lay the furrow at an angle of about forty-five degrees, or, in other words, to have one furrow lap over the other one a little, so that beneath the furrow there will be a small open space. This serves as a drainage from the top of the ground, likewise for the circulation of air, and has a tendency to keep the ground light.

But, in plowing their light soils, they adopt the reverse course, plowing their land very early in the season and laying the furrow as flat as possible. This would keep the soil in a more moist condition; consequently, the crop would not be so subject to suffer in the heat of the season.

At the time of my visit they were experimenting with the steam plow, which, I understand, was a success. There are several different kinds, but I believe the favorite plow to be one that had a small steam engine at either end of the field, the gang of plows being attached to an endless wire rope.

Raising Grain.—The grains and seeds of all descriptions are put into the ground by a drill. One reason for this is that the seed is put in all of one depth; consequently, the product is more even, every seed having an equal chance with its neighbor. This precaution, combined with the care and judgment they exercise in selecting the seed, secures very even and fine samples.

Their seed is all put through separators till it is perfectly clean, with all the poor, light and defective kernels taken out, and, after all this pains, in the month of June, when the grain is growing, they spend days and days and sometimes a month in picking out by hand every weed that has made its appearance.

Manures.—Their barnyards are generally about two feet lower in the middle than they are at the outside, which answers the purpose of holding the liquids. But in case of heavy rains, causing the yard to overflow, there is an outlet in one corner, which leads to a tank. When this is full, it is pumped into a hogshead on wheels, which is drawn upon the meadow and is drawn off into a sprinkler something like a street sprinkler.

They save and compost everything that will decay on the farm. They also use a great deal of lime.

Bones are saved with the utmost care, and either made into phosphates or taken to the bone mill and ground into what they call bone dust.

The flesh, blood and bones of an old horse are often worth more than he was when alive.

They import many thousand tons of bones every year from America to be ground up and used as manures. They import cotton seed and flax seed from America by tens of thousands of tons, which are ground, the oil extracted and the residue pressed into cake, which is fed to their fattening stock. The droppings, which are very rich, are afterwards used for manure.

Here, Mr. Chairman, is where the Englishman is too sharp for the Yankee. He extracts the oil, fats his cattle, manures his land and rejoices, while the American farmer that sells him the seed is groaning over his hard luck and a run-out farm, and says farming don't pay.

They import a great deal of guano, which is inspected by government inspectors, and, if found adulterated, the owner is punished by a very heavy fine.

They make use of a great many chemicals, which they buy by the pound in the market, and feed their crops the same as they do their cattle—that is to say, they take into consideration the crop they desire to raise, and then apply those manures and chemicals whose component parts enter into the construction of the plant to be raised.

They have special manures compounded by the manufacturers of artificial manures for certain crops. This is science in agriculture.

The professors of agricultural chemistry are all the time experimenting for the advancement of husbandry. They have large salaries from the government to aid them in carrying out their plans. They have the assistance and co-operation of the masses of agriculturists throughout Europe.

STOCK.—This system of farming is well arranged for their purposes—the turnips for the winter and the clover for the summer fattening of their stock. By this arrangement a continuous round is formed, by which the farmer can select the fattest of his stock every two weeks for the market.

They have live stock markets established at all the principal places every two weeks, at which the farmer generally sells from twenty to fifty sheep, according to the size of his flock, and he buys as many more lean ones to take back to replace those he has sold.

In Yorkshire, the most common breeds of sheep are the Leicesters and Cotswolds, the latter being the favorites among the majority of the farmers; but many other breeds are raised in other parts of the country, according to the pasturage and other circumstances attending them.

It is not uncommon to see whole flocks at two years old that will dress twenty-five or thirty pounds to the quarter.

I notice a very great improvement in the cattle, compared to what they were thirty years ago. They are nearly all of them high grade Durhams, so near full blooded that a person would have to be a very good judge to discover that they were not full bloods.

There is a great strife between the breeders of the Bates Durhams and the Booth Durhams.

I went to Warlaby to see the original herd of Shorthorns, owned and kept by Mr. Thomas Booth, and there I saw some of the best cattle in the world. The best cow that ever stood in England was there—consequently, the best cow in the world. Her name is Lady Fragrant. She is the winner of twenty-three gold and silver cups, and never was beaten.

So famed are the Booth cattle that all his young bulls are engaged or hired at very high prices by the farmers, to go to different parts of England, Ireland, Scotland, and even across the Channel into France, and other parts of Europe, for the improvement of stock.

It can be readily seen that, while their cattle are nearly full blooded, they still wish to improve them.

I saw but few Ayrshires or Jerseys, but suppose they may be kept in greater numbers in some other parts. The general complaint with them is that they are too small for beef, when past their usefulness for milk. Another objection which follows is that they have to raise all their calves, and this would diminish the size of their stock instead of improving them.

With their large population it is a matter of economy that is very forcibly brought to their minds, to produce the largest amount of meat from the smallest amount of feed; consequently, their cattle and sheep and swine are fatted to perfection, as a general thing. They cannot afford to sell an animal half-fatted, as we often do here in this country. An animal that is designed for the butcher is kept growing and fattening from its birth. To fatten a steer so that he will tip the scales at eighteen or twenty hundred, live weight, it is best to have him attain to that weight as soon as possible. Better to have him weigh that at three or three and one-half years of age than to keep the same animal six or seven years to weigh the same. You will see that they save two or three years' keeping, save the trouble of taking care of them, save the interest on the money, save the risk on the animal, and can fill up his place by other young stock.

GENERAL MANAGEMENT.—The European farmers have seen the folly of following a system similar to that usually adopted by us in America, and they have, within the past few years, not only improved greatly in farming, but have become more familiar with the collection of principles embodied in the science of their profession.

The same there as here, they condemn that which is generally called book farming, but the force of circumstances has brought to bear upon them great improvements, which were overlooked in times when their population was less massive.

Now, the application of science is universally studied, and by no other means can the resources of England begin to meet the demands of the people.

If in England they meet with more success by the application of science, in America, also, the farmer can illy afford to discard science in his profession and follow blindly the less desirable course.

With them, everything comes along in its time and place, and the agriculturist knows beforehand the amount of work he has to perform, both this year and next, or any number of years, almost, according to the size of the fields he has under rotation.

If I have brought to your notice points that will cause any farmer of Vermont to study his profession more closely I shall feel well paid, and will assure him that, by putting more mind and talent into his business, he will not only get well paid, but he will reap such satisfaction from his calling that we shall hear far less complaint about the farmer's life being a life of drudgery. His life will become pleasant, his family will be more satisfied to stop on the old homestead, and he will die a far wiser and happier man.

FARM DRAINAGE.

BY A. O. CUMMINGS, OF MONTPELIER.

In approaching the subject of "Farm Drainage," I feel a great degree of timidity; first, on account of its being a subject so little understood and practiced in this State; second, on account of its being a subject of such vast importance to the farming interests of Vermont, and requiring so much length to properly set forth its advantages and necessities; and thirdly, from the fact of my inability to do the subject justice. But if my disconnected ideas shall be fruitful in leading any to investigate the subject, and profit by such investigation, I shall feel fully repaid for my effort.

As there is a strong aversion to theoretical (commonly called book) farming, I shall confine myself, in the main, to my own personal observation and experience, occasionally quoting authorities to sustain the same.

First, what land needs draining? I answer by saying all land in which a post hole dug three feet deep, immediately after a *heavy* rain, or during the wet months of early spring or late fall, will contain water. Writers on the subject tell us that when a four foot hole contains water under the same circumstances, it needs drains; which, of course, would be a dryer soil. A plowed field which shows dark, damp spots on its surface is a fit subject for drainage.

All such soils are so filled with water that the particles of soil are immersed as perfectly as a barrel of potatoes is when the barrel is filled with water; you tap the barrel at the bottom and the water settles, and its place is as quickly filled with air, illustrating the exact action of drainage.

All rain water belongs to the soil on which it falls, and is one of nature's arrangements for fertilizing it when made to pass down through the first three feet and be removed from below, either by drain or through a porous subsoil. Every particle of rain water is impregnated with fertilizing matter, which is absorbed in its passage through the soil. The wonderful absorbing properties of earth are familiar to the most unlearned. To illustrate it, take a common flour barrel, knock out both heads, leach through it *liquid manure*, and the liquid that comes from the bottom will be *pure water*, all impurities having been absorbed in the downward passage,—precisely the action of rain water passing down through the soil and out through a drain.

Spring water does not belong on the surface of a field at all, neither should it be allowed to come within reach of the roots of cultivated crops. Water cannot stand in any soil within reach of the rootlets without checking their growth, similar to striking a flat stone at the same depth. The objection of too much water in our soil is forcibly illustrated in the process of the germination of our grain. The first growth, commonly called sprouting, requires none of the elements of the soil in which it is placed. It will take place as readily in a barren sand as in the richest loam, provided the necessary conditions exist, viz.: the exclusion of light, a certain amount of moisture, heat, and the presence of air. Any material which, without entirely excluding the air, will shade the seed from light, furnish the necessary moisture, and allow the requisite degree of heat, will favor the chemical change which we call sprouting In proportion as the heat is reduced by the action of evaporation, and as the air is excluded by water, is the sprouting retarded, and in case of a complete saturation for a certain length of time, which varies in different kinds of grain and plants, decay takes place, as we all know from our own experience. I have in my mind now an instance where a large field of potatoes, planted on a flat piece of land contiguous to a stream, was immersed by a heavy rain for a short time, three days, if I am correct, and not a hill grew except a few small patches on ground high enough to be above the water.

I have used the embryo plants to illustrate my ideas, as they more perfectly show the effect than more mature plants; but although the others may live through, they are materially affected by an unfavorable state of the soil. As all superfluous water must either pass down through the soil or be evaporated, we will consider the effect of evaporation on the soil.

Water exposed to the air is constantly "drying up," which is changing from a liquid to a vaporous form, in which form it occupies two thousand times more space than when in its liquid form, to maintain which it requires a large amount of heat, which is taken from the ground and air, which are thereby made correspondingly cooler. The practical working of this can readily be seen by reference to the change that takes place in a hot summer day when the mercury indicates 85 or 90°, and all nature seems parched. Let there come a shower, and the water falling be evaporated, and who has not noticed the change in temperature.

Dr. Madden found that the soil of a drained field, in which most of the water was removed from below, was 6½° warmer than a similar soil undrained, from which the water was removed by evaporation. The difference of 6½° is equivalent to an altitude of two thousand feet.

Writers estimate that during the summer months three inches of water per month are evaporated from wet soils. Three inches of water over the area of an acre would weigh two hundred and seventy-five tons. The amount of heat required to evaporate this must be very great, all of which comes from the air and earth, which becomes reduced in a similar ratio, which accounts for the old expression, "cold, wet land." The more completely we withdraw this water from the surface by drains, the less is the temperature of the soil reduced by the process of evaporation. To illustrate the deleterious effects of evaporation, let me take as an example a rain fall of one inch on an acre, one hundred tons, which would require all the heat contained in ten tons of coal, a large share of which is absorbed from the earth, consequently lowering the temperature of the soil, which has a backward tendency to both the germination of seeds and ripening of crops. Gisborn says the evaporation of one pound of water lowers the temperature of one hundred pounds of soil 10° ; that is to say, if to one hundred pounds of soil, holding all the water it can by attraction, but containing no water of drainage, is added one pound of water which it has no means of discharging except by evaporation, it will, by the time it has discharged it, be 10° colder than it would have been had it had the power to discharge it by filtration, which is more practically stated thus: If one pound of water to one hundred pounds of earth already filled be added so that it is to be lost by evaporation, it lowers the temperature 10°.

Had the same soil the means of ridding itself by drains, no effect is produced beyond what is due to the relative temperatures of the rain and of the soil. It is known by actual trial that four times as much heat is required to evaporate a given quantity of water as is required to raise the same amount from the freezing to the boiling point.

Another serious disadvantage of water in a soil is seen from the fact that if a soil is filled with water it prevents the access of air, and the soil must necessarily be of the temperature of the water it contains, which, if it could be withdrawn by drains, would soon be filled with warm air from above.

Mr. Josiah Parks, an eminent writer on drainage, says the result of thirty-five observations showed the drained soil, at seven inches in depth, was 10° warmer than the same soil at the same depth undrained. He further says that the undrained soil, at the depth of seven inches, never exceeds 47°, while after a thunder shower the drained reached 66°, a difference of 19°; and further, he found at a depth of two and one-half feet it was 48°, considering which, we see what the effects must be in a hot day with the earth's surface and the air heated to a great degree, and a shower of rain coming and carrying this heat down in its descent, among the roots of plants.

Lest some may think that in a dry year we shall be more subject to drouth if we underdrain, I will say: Experience has proved the result to be exactly the reverse, the rationale of which is plain when we consider what takes place in a drained soil. We have seen that as the water is withdrawn from the soil by the drains underneath, the air, which is filled with vapor, follows down into the cooler particles of earth, and is condensed into liquid, and furnishes water for the plants. We can easily test the truth of this by taking two boxes of dry earth, one four inches deep, the other eighteen inches deep, and exposing them to a hot, mid-day sun. The shallow box will dry through, while the deep one will condense moisture from the air in its lower particles, and in a short time become moister than when placed there.

In addition to what moisture is thus condensed in all porous soils, moisture is continually drawn up by absorption. All other circumstances being similar, plants will be affected by drouth in proportion as their roots are long or short, and nothing tends to deep rooting like under-draining. The past fall, having to excavate a piece of land, we found thistle roots eight or nine feet below the surface, and leaving the work a few days on account of wet weather, to our surprise we found those roots had put forth leaves. I have frequently found carrots grown in an under-drained piece of land that measured eighteen inches in length, with the ends broken off where they were as large as a pipe-stem.

Near Newark, New Jersey, is a farm owned by Professor Mapes, of superphosphate notoriety, which has been rendered almost indifferent to the severest drouth or wettest season, by a thorough system of under-draining

George E. Warring, of Rhode Island, says: "With our land thoroughly improved by draining, we may carry on the operation of farming with as much certainty of success, and with as great immunity from the ill effects of unfavorable weather, as can be expected from any business where results depend on such a variety of circumstances. We shall have substituted certainty for chance, as far as it is in our power to do so, and shall have made farming an art rather than a venture."

The farmer, more than any other class, accepts his lot, and plods through his hard life, piously ascribing to an inscrutable Providence the trials which come of his neglect to use the means of relief which lie within his reach.

Perhaps some one is thinking this is all true, but will it *pay* to go into this expense? We Yankees are looking into the "will it pay?" too much for our own good, many times. But this is not one of those cases. It will pay in dollars and cents, as I shall attempt to show. I am satisfied that where land is worth fifty dollars per acre, or where corn is worth one dollar per bushel, or hay fifteen dollars per ton, it will pay. I have seen a meadow of fifty acres which produced nothing but swamp grass and flags, a part of which was too wet to hardly step upon. The value of all that could be taken from it would not pay for the labor, taxes and fencing, and yet this land was converted by drains into a field on which fifty bushels of corn, or two hundred bushels of potatoes, or sixty bushels of oats, or three tons of good English hay, was raised per acre yearly; and it could be plowed with an ox team on any of its parts; all of which was done at an expense of less than sixty dollars per acre, or $3,000 for the whole field. Let us see. The interest on $3,000 at six per cent. is one hundred and eighty dollars per year. On that meadow was and is now raised more value than from any farm of one hundred acres in the town of Cabot.

I had a field of three acres which produced nothing of value, owing to the water which filled the soil from innumerable springs and slough holes, which, by an expenditure of one hundred dollars per acre in under-drains, was made to produce two crops of hay per year, of an average of three tons per acre, worth twenty dollars a ton.

And to come nearer home, we have but to go up to Mr. L. C. Fisher's farm, only half a mile distant, and see the effect produced the first year, to be fully satisfied that under-draining will pay. Mr. Fisher commenced last year with half a car load of drain tile. He afterwards bought one car load, and now thinks so well of his work that he is about purchasing another car load, and I prophesy that the next year will show him greater improvement than the last.

Were it not that it might seem egotistical, I could tell of an acre of land which I under-drained, near my present residence, from which I have received greater benefit than any named. My predecessors gave away its yearly production of grass for the cutting. We are now cutting more than three tons of hay yearly from the same, besides fall feeding it four months.

Having thus far directed our attention to the necessity and practicability of under-draining, we now come to the mode of doing the same. I say that any man of good common sense and judgment can lay out a system of drains, after having seen one that has been skillfully done, and having acquainted himself by a little study of the lay of the land, and information from the one who has done the work.

At what depth shall the tiles be laid? My own experience has been, from twenty inches to three feet deep, the latter figure being my judgment after several years' 'experience on as many different fields. In support of my views I quote Mr. Johnson, of the State of New York, than whom no one has greater practical experience; also Solon Robinson, agricultural editor, for years, of the *New York Tribune.* Still, many modern writers advocate four feet drains, among whom I might name Messrs. Gisborn, Parks, Mechi, Warring and others, and I am not prepared to say that four feet is not better than three; but never having done a job, or observed the working of four feet drains, I am unable to speak from personal knowledge upon that point.

Having decided to drain, and at what depth we will place the tiles, we now come to what materials are needed and how to use them. A kind of drain is made by digging a trench of the necessary depth, and placing a small cobble at the bottom and at *one edge*, and then placing a flat stone with one edge resting on the cobble, and the other edge on the bottom of the ditch, on the opposite side, leaving a space underneath for water, then covering the same with small field stones, to the depth of eighteen inches, and leaving the same depth for dirt on the field stones. Another, and still better mode of construction is by placing two cobbles or round stones in the bottom, at each edge of the ditch, leaving a space from four to six inches square between them, and placing a flat stone on those, leaving much more space, and less liability to fill up; then proceed as described before. I saw a field last season, in which this kind of a three feet drain was laid by myself, in 1861, and it was as perfect, to all appearance, as when finished, discharging a large quantity of water.

I have been told by help that I employed, from Ireland, that in the mother country drains are often formed by digging a trench the required depth and breaking up stones, the largest of which are not bigger than a partridge's egg, and throwing them in promiscuously to the depth of eighteen inches, then covering lightly with something to keep out the dirt until it gets settled, a precaution necessary in all stone drains. For this purpose I have used sods, laid on with the grass side down, and also coarse litter like swamp hay, straw or wood shavings. I have also seen a very good main drain formed by scraping out a deep channel, eight or ten feet wide and four or five feet deep, and filling it with large boulders, the size of the capacity of the team to haul, then filled in with smaller stones, and lastly levelled with small field stones, leaving some two feet for dirt to level the surface. This kind of a drain was a sort of a "kill two birds with one stone" operation, it being in Massachusetts, where there were so many stones that we were at our wits' end to get them from the surface of our fields.

We now come to the cheapest, easiest constructed, and most durable of all known drains, viz.: tile drains. The tiles are made of clay and sand, and burned like common brick. These are of several different patterns, but as time forbids, I will only mention the most approved kind, which is sole tile. It consists of a round bore of the necessary size, with a flat sole or bottom on which it rests. Some have been made square, and others round with a collar of the same material, which extends some one and a half inches into each end of the tile when laid, covering the joint so as to keep out dirt or silt. The laying out or engineering is an important operation, all writers on the subject putting so much stress upon it as to claim the necessity of employing a practical engineer; and there may be cases in which the land is so nearly level that it would be necessary to use a surveyor's level in order that the proper grade may be obtained at all points, an *absolute necessity*, else the drains will be utterly useless above all such points.

The first thing to determine is where the water will be taken from the field, which, in nearly all cases, will be at its lowest boundary, and must always be where there is a good fall—otherwise, the silt or mud from the drains will soon clog the mouth, and it will fill back as fast as mud or silt enough finds its way into the tiles, and in a short time would become useless.

Usually we run a main drain from this point through the lowest part to the farthest boundary of the lot; then lay lateral drains, running into this at an acute angle between the main and these laterals, never being laid in right angles, and on a smooth piece should be laid parallel, and at intervals proportionate to their depth. Scientific writers say twenty feet apart for three feet drains, forty feet apart for four feet drains, or eighty feet for five feet drains. My own custom has been forty feet apart for three feet depth; but, in most fields, inequalities of the surface govern the localities of many of the drains.

When the border of a level wet piece which is to be drained is higher land out of which water seems to ooze, my practice has been to run a lateral parallel with the high land and at its base to catch the same, although writers advocate the running of laterals up into the high lands and parallel to each other, which may be the best, but it is not in accordance with my custom.

After the ditches are all staked out, we commence at the lowest point and dig our ditches all through, without the land is inclined to cave, in which case we must dig a short distance and then lay our tiles, and so on up the whole length, unless we can afford the time and expense to brace up the sides with boards.

When we dig the whole length of ditches before we commence to lay our tiles, we begin at the *upper* end, putting a stone in the upper end of the first tile to keep out dirt, and work *down* the ditch, thus preventing the liability of dirt or stones getting into the tiles.

In all cases in which I have laid tiles, I have placed a narrow strip of board, three or four inches wide, on the bottom of the ditch, on which to place the tiles, thereby insuring an unbroken grade for the tiles,—an indispensable requisite in all soft ditches, where one tile would be liable to settle more than another, thereby breaking the connection between the different tiles and destroying their utility.

The size of tiles to be used will be governed by the amount of water to be carried off, and the steepness of the grade. But, as a general rule, they will not be required as large as would be at first supposed. Two inch bore are the smallest I have ever used, and three inch bore the largest, although they are manufactured from one and one-half to six inch bore; but the amount of water that a two inch tile will carry will make quite a stream at its outlet, after having been discharged and spread itself on the ground. Any one who has ever carried the water of a large spring in pipe will have noticed how much smaller the stream appears when condensed into a round stream by its introduction to the pipe.

Warring, in his book on draining, gives the following table of sizes required: For two acres, one and one-fourth inch tiles; for eight acres, two and one-half inch tiles; for twenty acres, three and one-half inch tiles; for forty acres, two three and one-half or one five inch tiles; for fifty acres, six inch tiles; for one hundred acres, one eight inch or two six inch tiles.

Messrs. Shedd & Edson, of Boston, prepared a table, based on Smeaton's experiments, for different sizes of tiles laid in different inclinations or grades, in which they state that a one and one-half inch tile, laid with a fall of one foot in one hundred, will discharge twelve thousand and fifty-five (12,055) gallons of water in twenty-four hours.

The only disadvantage of the small tile would be that it would take a longer time to rid the soil of a fall of water than a larger one; but, to offset that, it has the advantage of running more swiftly, and thereby clearing itself more perfectly from an accumulation of silt or mud, which, in some uncommon cases, will require more than ordinary care to prevent its accumulation and the stoppage of drains.

I never saw but one such instance, which was where the water came from a side hill of quicksand; a two inch tile placed at its base, with very slight fall, filled in two or three days after it was covered, perfectly stopping the tile. The case in question occurred last fall, and was on property in which I am a part owner, and was done by another member of the firm, who had had no experience in tile drains, and has concluded to pass it over for me to experiment on the coming season.

My mode of operation will be to dig the trench, place a board on the bottom, lay the tiles and place a covering of clay six inches deep over them and firmly press it down; or try an experiment with leather shavings, by placing a covering three or four inches deep (an abundance being handy from our currying shop); after which I shall fill in the quicksand, and I have great faith to be able to report a success next season.

There are devices recommended by writers on drainage, the object of which is to get rid of any silt that may accumulate in tile drains, the practical working of which I know but very little, having seen but one.

Their construction consists of what is called a silt basin, formed by making a chamber in the tiles. It may be made of brick or stone cemented; or a large tile six or eight inches in diameter may be set on end at least one foot below the bottom of the ditch and extending to the top of the ground, one tile ending on one side and the other commencing on the opposite side a little lower down. As will be seen at once, all sediment running into this will be deposited in the bottom, and can be cleaned out from the top whenever there is an accumulation sufficient to fill it to the bottom of the tile which is placed lowest.

This can be built or put in as often as desired, and, it is claimed, will obviate all risk of the tile clogging from silt. But I think a properly laid drain, in any ordinary soil, where there is sufficient fall to give a current, will last longer than its maker, without silt basins.

The only stoppage I ever have had has occurred at junctions—i. e., where the lateral has met a main, and the joining has not been as good as it should have been.

We always make a junction by breaking one tile of the main and one of the lateral, so that they will fit like the point of a crotch harrow. As it is rather a difficult job to break them so as to make a perfect joint, it is well to place some sort of a covering over all such joints. I have used a flat stone; again I have used a covering of old litter or straw, or leaves, anything of the kind which can be handily procured.

All writers on the subject recommend employing an engineer to lay out the drains, and have an accurate map of the same drawn on paper for future reference. If, at any time, any portion of the drains are to be opened for any cause, the map is consulted, and, by finding the exact relative location on the map to some important points designated on both map and field, like a tree or large stone, it is at once found, without digging at random, at a depth of three feet, for the tiles. But my experience has been that where a net work of drains has been laid and the field seeded to grass, we could stand at any point on the field where the eye could see the whole length of the drains, and trace them as readily as you could furrows plowed in the sward—the grass being taller and looking greener; and, on a plowed field, it would sooner dry after a rain. and the dark look to be seen on wet plowed land would soonest disappear over the tiles.

I would not wish to be understood as deprecating any of these adjuncts in drainage. If we wish to do the work in the most approved style there are many little extras that can be used; but I have tried to disrobe it of all superfluties, and make it appear as plain, cheap and commonplace as possible, that it may not strike a dread to those unaccustomed to seeing the work done.

I have made no allusion to the actual cost per acre, for the reason that draining is done under such a variety of circumstances that, at best, it would be arbitrary. For instance, it would cost less per acre on a fifty acre lot than on a single acre. Again, one lot may be a muck meadow, which can be spaded out and the pick not used at all; while another may have a hard-pan at two feet in depth, which almost defies the pick, and still another may be almost filled with stones, some of which are so large they must either be split or blasted; again, a field may have a rock bed for its outlet, which must be lowered, at considerable expense, before commencing with the ditching proper.

In the fifty acre field to which reference was had in the fore part of our paper, in which three thousand dollars was expended in draining, one thousand dollars was expended in the first twenty rods of the outlet, it being almost a solid rock bed.

Again, labor at different times and places commands different prices, any farmer knowing best what it will cost him with his facilities to excavate and fill a ditch three feet deep on his soil.

The tiles are much more expensive than there is need of their being, from the fact that there is so little call for them that there are but few manufactories of drain tile, consequently little or no competition, which state of things would soon be done away with were they more generally used, as I believe they eventually will be.

The nearest point at which they are manufactured is St. Albans Bay, Vermont, Mr. E. T. Jewett being the manufacturer.

His prices, delivered on board the cars at St. Albans station, are: Eleven dollars per thousand for two inch tiles; seventeen dollars per thousand for three inch, and twenty-four dollars per thousand for four inch. The pieces are cut fourteen inches long, but, in burning, shrink in length so as to measure only about thirteen inches long, which would make the cost per rod, exclusive of freight, about sixteen cents for two inch, twenty-seven cents for three inch, and forty cents for four inch tiles.

He now sells about three hundred thousand yearly, and informs me that his sales increase yearly.

Drains once well laid need little or no attention afterwards, provided there is sufficient fall at the outlet so that the mud deposited will not check the flow of the water, a point which should be looked to at least each spring and fall.

There are many points upon which I should have dwelt more particularly; also many minor points on which I should have touched, had not the length of this paper admonished me that I must close.

DISCUSSION AT CABOT.

At the conclusion of the paper, Mr. Fassett said he wanted to endorse Mr. Cummings. He had been experimenting in under-draining upon his own farm, with satisfactory results. Thought it a profitable investment. He wanted to know if Mr. Cummings had ever been troubled with the growing of roots in his drains.

Mr. Cummings—I never had any trouble with tile drains, but think there is some danger of this in stone drains.

Mr. Fassett—Have you ever seen branch tiles for the junction of the laterals with mains ?

Mr. Cummings—Yes, but I have never used them. It is indispensable, in order so keep your drain, to watch its mouth, and keep that all right.

Mr. L. C. Fisher, of Cabot, said he thought the benefit of tile drainage could not be estimated. He saw the effect of it on his land at once. It might cost a good deal, but, in his opinion, was a better investment than government bonds, and was a permanent improvement. He thought it wise to improve wet places in pastures, as they were the best and most valuable part of the farm.

Mr. Fassett said drainage also improved the sanitary condition of things.

Col. John B. Mead, of Randolph, said he wanted to add his testimony to the importance of drainage, and gave an account of his own experience in draining.

Mr. Cole, of Danville, said his own experience agreed with that of those gentlemen who had spoken of the benefits of drainage, and on an acre of land which was worthless before draining, he had got a yield of eight tons of oat hay, from twelve bushels of oats.

CAPITAL IN FARMING.

BY E. R. TOWLE, OF FRANKLIN.

One very great obstacle which farmers have is the want of capital to enable them more successfully to prosecute their calling. This want is wide spread, not confined to a few individual cases, but applies pretty generally to the occupation. There are but comparatively few farmers who have a surplus fund, or, if they have, who are willing to use it for the benefit of the farm. A large proportion of farmers are in debt for their farms, to a greater or less extent, and all their energies are directed to liquidating the claims of former owners. This, of course, leaves very little or nothing as a reserve fund for farming operations beyond what is actually necessary to carry on the farm, and this, too, often in an imperfect manner.

Whatever the farmer can accomplish unaided, with the imperfect or inadequate means at command, by way of improvement upon the farm, or in adopting a better system of cultivation, is about all that is attempted, and anything farther is put off until that long-looked-for time in the future, when the debts are paid.

During this interval, often of many years, the farmer's own strong hands and those of his equally faithful wife, constitute, to a great extent, the only available capital stock, and with this a very great work is accomplished, and, apparently, a large percentage yielded, but it is too often at the expense of the investment, and when at last the load is removed, the farm free from encumbrances, the earnest, toil-worn workers are very much in the condition of a house let to a careless tenant, *much the worse for wear.*

It is a lamentable fact that far too large a proportion of the present generation of farmers and their wives, now in only what should be the meridian of life, are, to a greater or less degree, broken down in constitution and health from over work. This comes from not being able or willing to secure sufficient help for the wants of the farm, and from performing labor at a disadvantage through lack of proper tools, implements and proper conveniences for the purpose. This does not arise from ignorance of a better way, although, when viewed in its final results, it may well be attributed to this, but lack of means, or, where these are ample, a disposition to employ them in such a manner as shall tend to alleviate extreme personal labor, and, in so doing, prevent the effects described.

But the lessons learned while in this school of excessive toil and privation, are very apt to be remembered and practiced when there is no longer occasion for this self denial. Here is an error that should be corrected. Many farmers are too ambitious, or, at least, they allow this trait of character to lead them in wrong directions. When the home farm is paid for, an adjoining one presents such attractions as are not easily resisted, and instead of employing the surplus means that would accumulate after the debts are paid in improving the land already possessed, and in making life easier and happier withal, the désire to become a large farmer is allowed to assume pre-eminence, and self, wife and children are taxed anew to carry out this midsirected ambition, that has prevailed in our State to such an extent as in many communities to dispossess nearly every other farmer, and add his possessions to his neighbor's.

While it may be expected that the farmer, in paying for his home, should direct his best energies in this direction, even for this purpose denying himself and family many of the comforts and conveniencies of life, neglecting numerous opportunities for useful improvements, however much desired, for the want of means, it is poor policy, and still worse economy for the farmer to keep adding to his landed possessions, involving himself continually in debt, and in a routine of hopeless labor and care, with no prospect of alleviation—for these overgrown farms, even when paid for, require constantly a great amount of work, watching and anxiety to keep them even in running order—and pursuing still the same mistaken course, as relates to a better system of cultivation, bringing forward in justification the oft-repeated words: "No money for these things, must wait till I get out of debt."

To give a little insight into this "absorbing process," I will quote from the 27th Annual Report of the Vermont Farmers' Insurance Company for 1874. There are, it is said, at this time in the town of Whitingham, 33 unoccupied farm houses, 27 in Wilmington, 33 in Halifax, 23 in Marlboro, 20 in Townsend, &c., all in the County of Windham; and so it is with the principal parts of the State away from the immediate lines of railroad. I think the number will be much larger in some parts of Franklin County.

I would not wish to have it inferred that large farms cannot be well managed or made profitable, but it will require a greater amount of labor and attention, in proportion to size, than smaller ones, while the want of capital is just as apparent, and the same course pursued in relation to an improved system of agriculture.

Very many of our farms are too large, as at present managed, to produce the best results. The territory is too extended, too much ground is gone over, requiring extra travel, labor and attention, and the income is not in the same proportion to the outlay as in farms of smaller dimensions.

Where is the farmer but will admit that he could do so much better if he had the means at command, that, indeed, he knows much more about farming than he practices, for this very reason? Most will even admit that their farms, rightly managed, might be made to produce fifty, or even one hundred per cent. more than at present; yet, knowing this, with strange inconsistency, instead of going to work to produce these results, will purchase another farm, using the money for this purpose that might have been more profitably employed in so improving what was already possessed as to double the returns therefrom, and render the cost of production less, from the better condition of the soil, arising from intelligent methods of cultivation.

And here allow me to say to those having farms of one hundred and fifty acres, or one hundred, even, paid for, of average condition, and presenting the usual capabilities for improvement, do not sell or trade them off for larger ones, and in so doing involve yourselves in years of toil, perplexity and even hardship, as this, in most cases, will be found a mistaken idea and one that will not pay, in the true sense of the word.

No, rather save the money that is being made on the little farm ; save the interest that would be continually accumulating upon a larger one unpaid for, and do not put it in a bank where fire might consume it or rogues run away with it, but employ it upon that little farm, arousing its hidden energies, developing its latent resources until it becomes a marvel of fertility and productiveness to yourself and all who behold it, and worth as much, intrinsically, as many an estate of three times its dimensions, as often managed, and dearer than a farm of a thousand acres, with a slip-shod style of farming entailed upon it.

Do you think, brother farmers, that this is a fanciful idea, hard to be realized, and that it would require a good deal of faith in our occupation and its possibilities to be successfully followed out ? I trust you will not, when you carefully investigate the matter, with the sincere desire to arrive at a just conclusion. It is fully as practical as the fact that a cow that will make two hundred pounds of butter in a year is worth *three* times as much as one that will only make one hundred pounds in the same time ; and who that has figured out this example will deny the truthfulness of the result ? The most of us might and should, if we had means at command to enable us to do, and a disposition to use them carefully and practically for the purpose, double most or all of the productions of our farms, at least above the general average. The product of our meadows should be two tons of the best quality of hay, instead of one to the acre; our crops of corn eighty bushels or more, instead of one-half of this amount, and of oats and potatoes in the same proportion. Our dairies might be made to yield a product of two hundred and fifty pounds of butter annually to a cow, and the quality of this should at the same time be so improved as to command an increased price in addition. I believe this to be practicable, and what most of us need to accomplish these results is capital, and an intelligent use of the same.

The English farmer does not own the farm he works, but rents it from some large land-holder for a term of years, paying therefor what would be considered by us a very large price, and is required in addition, or the necessities of the case demand it, a floating capital or sum of money equal to so much per acre, to enable him to work it to the best advantage, in order that he may pay the rent, support his family, and lay by something for future use.

This capital is used in draining the land, if it has not been already done, providing suitable implements and machines, labor to carry on the farm in the most thorough and systematic manner, and notably for the purchase of special fertilizers and feeding stuff—large quantities of which are employed, the object being, in the first place, to put the land in the best condition possible, by drainage and cultivation, in order that the full benefit of the fertilizers applied may be realized, and large crops harvested, in the consumption of which, and with that purchased, a large amount of rich manure is afforded for the further enrichment of the land and the production of still increasing crops.

The English farmer, to be successful, must have plenty of manure, and for this purpose he purchases bone dust, guano and superphosphates, raises large quantities of root crops, sends to the United States and gets linseed oil cake and cotton seed meal, which should be used here, and feeds to prize mutton sheep and to the best beef-producing breeds of cattle for the purpose of increasing his stock of manure, rich in plant food, for future use.

While accomplishing this, his lands are continually growing richer, the crops increasing in abundance, the yearly rental and expenses of running the farm are provided for, and still there is a surplus left for the farmer in his declining years.

All this could not have been accomplished without capital and a judicious use of the same. With our system of farming, as generally pursued, utter failure would have been the result.

I find in a description of the little island of Jersey, not as large as two of our towns, and from which the somewhat celebrated breed of cows bearing the name are imported, that it is densely inhabited, containing a population equal to two persons to every acre of land. The farms have been divided and sub-divided until they contain only from two to sixty acres each, there being six or eight of the latter dimensions, and such is considered their value for agricultural purposes that they are rented at from twenty-five and one-half dollars to forty-five dollars per acre. This is something remarkable, and tends to show what can be done on very small farms. I would add that the people obtain a good livelihood, and are prosperous and happy, being subject to visits from neither tax gatherers nor custom house officials.

And now, to come home again. If we had a reasonable amount of capital, we might not at first accomplish as great results as our English brethren, who have a much greater experience in the matter, and whose lands are supposed to be already in a condition to yield the best possible returns for money invested, but I believe we can make it pay a good interest on the investment.

Some may inquire how we could use capital, provided we had it, to the best advantage on the farm.

I will mention some of the obstacles in the way of good farming, and what might be expected provided they were removed. In the first place, many of us have fields, or parts of fields, that are really unfit for cultivation, for the reason that they are too wet. The soil is naturally good, and would produce abundant crops if it could only be sufficiently and properly worked, and at the right time. But, in its present state, this cannot be done, and for this reason the crops are late and scant, and the land is not worth half price. Now, what is wanted here is drainage, and, when this has been properly performed, the land can be plowed in season, the soil will become light and friable, manures can be applied with a certain prospect of their operating beneficially, seeds put into the ground in season and maximum crops harvested.

To secure these results, money will be required—otherwise time, labor and material; and although the cost in some cases may be large, yet, if the work is properly performed, it is a permanent investment, transforming a wet, cold and almost barren field into a fruitful one, enabling the farmer to sow his seed and gather his crops in their proper season and under favorable conditions.

Now, let me ask which would be better, to drain this field that may be supposed to be twenty-five rods from the barns, at a cost of say forty dollars per acre, and thereby double these figures in its real value, or go a mile away from home and buy more land at the price per acre that it would cost to drain this?

There can be but one answer; yet I fear many would buy more land in preference to improving thus some that they already possess. If there be any such, I would say, study the matter over carefully and see if the practice is not entirely wrong, and in pursuing which loss will very likely be sustained in the end.

On most of our farms in this part of the State an abundance of stones is found. These are often a great hindrance to all farming operations, and should be removed. This will cost something, but once done and thoroughly done, and the improvement will be so marked and gratifying that the only wonder will be that it was not done before.

I have lately had a field cleared of stones, mostly large and having to be split and blasted in order to remove them. These stones were of good quality, and were made into a substantial wall by the roadside, that will neither decay nor be blown down by the wind.

Formerly, it was difficult to plow the land, some of the best on my farm, or run a mowing machine or horse-rake over the surface, on account of these large stones so thickly scattered about. Now, the surface is clean and smooth, the appearance much improved, and, although it cost thirty dollars per acre, I call it a good and permanent investment.

We want money to clear our fields of stones, put them into walls and under-drains, and not into little heaps as we sometimes see, and farming will become easier, more pleasant and profitable withal. We need a good variety and quality of farming tools, implements and machines, those that are the best adapted for our farms.

We can not make good work with a poor plow or mowing machine, and find it difficult using a miserably constructed hoe or shovel. This is not now necessary, as a good variety of all these are provided, from which to make selection. Some judgment and care is necessary here, in order to select those implements that are best adapted to perform the work we require of them, and we must not expect too much of one ; that it will be able to perform the best work upon all soils and under all conditions. We should have the best tools and implements, use them faithfully and take good care of them.

I will say nothing of farm buildings, only have them comfortable and constructed with particular reference to the use to which they are devoted.

Do not waste capital in erecting an eight thousand dollar house or a five thousand dollar barn upon a six thousand dollar farm. This is not true economy ; neither will it be an investment that will pay a very large percentage, when viewed in a pecuniary point of view.

Most farmers employ too little help to produce the best results and, in consequence, the work upon the farm is often performed in an imperfect manner. Our springs are short and a large amount of labor has to be compressed into a very brief period of time, in consequence of which it is hurriedly performed.

To make up for the deficiency in time, we need more help, in order that the soil may be properly prepared for the reception of seed, and in the after cultivation of the crops. There is an adage that "tillage is manure," and, to a certain extent, this is true. It is, indeed, a very important part of our system of agriculture, and should be considered as such. There is also another saying, that "haste makes waste," which, as regards getting along in a hurry with our farming operations so as save time and expense, regardless of how the work is performed, is a true one, and, whenever practiced, the source of innumerable evils.

We need more labor to be judiciously expended upon the farm—in other words, the employment of capital that will be returned in full, with use, in the improved condition of the soil and increase of crops, resulting from a better system of cultivation.

Perhaps I may be allowed to add here that hardly a farmer has manure enough for the purposes of the farm, and is confident that, if this deficiency was supplied, much better returns could be made. There is no doubt of this. It is, indeed, the great want of the farmers of to-day, and one that, by some means, should be supplied. To a certain extent this can be done, if there is time to devote to the purpose or means at command to furnish help.

When we consider that every two-horse load of manure made and saved upon the farm is worth at least one dollar for use upon the same, and that the amount made might be doubled without injury to quality, in the bedding of stock, use of muck, loam and all kinds of refuse material, used as absorbents and for composting with fresh manure, any one can calculate for himself if it will not be time, labor and money well expended in attending to this matter, much better, indeed, than in many of the investments now made.

I have hinted in the earlier part of this paper at the methods of the English farmers, employed almost entirely for the purpose of enriching their lands in the purchase of special fertilizers, and of feeding stuff to be fed to fattening animals, that in this way an abundance of rich manure might be obtained. Cannot we learn something of advantage here? the importance of feeding all the crops raised upon the farm and of purchasing grain and provender in addition, when it can be obtained at reasonable rates? I think we can.

And here, again, is where we need capital, to enable us to take advantage of the markets and obtain our supplies when we can get them at the lowest figures. We lose too much in being obliged to make our purchases just when needed, in paying the highest price for them, and in running upon the credit system.

If we had money we could often manage to make a great saving in buying what will be needed a little out of season —most will understand this—besides better business habits will be formed in so doing. Intelligence must be sought after and obtained, the run of the markets kept, and, altogether, our occupation will assume a different aspect, and become of increased importance to all concerned.

I have thus as briefly as is consistent with my subject glanced at the obstacles in the way of good farming, and the great want of capital, in the judicious use of which they may be removed and a better system of agriculture instituted.

To accomplish all that has been spoken of would, indeed, be a serious undertaking and require a considerable outlay; but it is not to be supposed that all the obstacles mentioned are to be found upon every farm, or in equal degree, or that the improvements hinted at are the work of a brief period of time, but that years, even, may be required in their accomplishment.

As farmers we may be able to see in what respects we, personally, could be benefited by the employment of capital in our occupation, and there are few here, I think, but that will admit the possibility of positive improvement in their system of husbandry and consequent condition resulting therefrom to their lands and themselves, if they had even a limited amount of capital to employ, as good judgment and intelligence would dictate, upon the farm.

How this capital is to be obtained is another matter, and not so easily to be decided. The adding of farm to farm has already been spoken of and need not be repeated. A little farm, well tilled, is better than a large one carried on in a slip-shod manner, is a self-evident truth, and if most of these large farms were divided, one-half disposed of and the value of the same employed as a reserve fund for the improvement and better cultivation of the other half, our farms would be benefited as a class, and neighborhoods and communities in a like manner, from the increased number of land-owners and homesteads, and from the superior methods of agriculture that would be adopted as the result of the employment of capital wisely and judiciously upon the farm.

PISCICULTURE WITH REFERENCE TO FARMING.

BY GEORGE B. FRENCH, OF WOODSTOCK.

Whatever of new discoveries there are in art or science which can increase and cheapen the food supply of a Nation are interesting, not only to its political economists, but to its thinking practical farmers. To say that everybody must eat, and therefore everybody is interested in what they eat and how it is produced, and what it costs to produce it, would be an absurd species of reasoning. True enough it is that everybody eats, but what portion of them care anything about where it comes from, or know or think anything about the labor, the cost, and the successive stages through which the material must pass before it becomes food? There is a large class of people who, producing nothing themselves, contributing absolutely nothing in any shape to the general welfare, think not and care not about these matters. They are living examples of the injunction to "take no thought for the morrow" in all its literalness, and believe that "sufficient unto the day is the evil thereof." Vermont farmers do not belong to this class. Producers themselves of a large share of what they consume, they are directly and pecuniarily interested in everything which relates to the production of breadstuffs, meat or fish. They make a note of every new branch of husbandry, and of all means to increase the capacity of their farms. Varieties of products and new methods of cultivation are worthy of their attention, because all these things have reference to the increase in the supply of healthy and nutritious food.

The different topics connected with the tillage of land and the rearing and management of domestic animals will claim a large share of your attention at this meeting. I propose to occupy a few moments of your time with a subject which is beginning to attract considerable attention as a new branch of husbandry, and which has been called the "Agriculture of the waters": Pisciculture with reference to farming. You will not expect me to discuss this subject in a scientific way or as an art, but rather as a business and an employment, and with reference to the question as to whether it can be made available and practical to the farmers of Vermont, as a means of increasing the products of their farms. Without attempting much then in the way of scientific investigation, and avoiding as much as possible scientific phrases, it becomes important to know something about the nature, habits and characteristics of fishes, and more especially those which inhabit our inland lakes and fresh water streams.

The tens of thousands of years which have elapsed since the earth first assumed shape have materially changed the forms of animal life. As upon land, so in the water, nature has changed her forms of animal life, even since the oldest times of which we have authentic history. And this change has probably been as great in the water if not greater than upon the land. Long before the species of fish which now inhabit the water had any existence, oceans and seas were populated with monsters, various in form, shape and size. These, unless we give credit to the frequent stories we hear about sea serpents, some of which we must acknowledge are well verified, have almost entirely disappeared, and have given place to other and more useful species.

There seems to be considerable confusion among the writers on comparative anatomy in regard to the classification of fishes. This is not strange, perhaps, in view of the almost incredible variety and number of forms. One popular writer on Zoology, in alluding to the causes which produce so great a difference in the character, temperature and density of both salt and fresh water, says: "We need no longer be astonished at the infinite variety in the forms and endowments of the finny tribes, or surprised that some of them are of shapes that to our ignorance appear monstrous and deformed, while others are very paragons of elegance and beauty. Many fishes, indeed, are adorned by the hand of nature with every kind of embellishment—variety in their forms, elegance in their proportions, diversity and vivacity in their color; nothing is wanted to attract the attention of mankind. The splendor of every metal, the blaze of every gem glitter upon their surfaces; iridescent colors, breaking and reflecting in bands, in spots, in angles, or in undulating lines, always regular or symmetrical, graduating or contracting with admirable effect and harmony, flash over their sides. For whom have they received such gifts? they who can at most barely perceive each other in the twilight of the deep, and even if they could see distinctly, what species of pleasure can they derive from such combinations?"

Following the example of Cuvier, the acknowledged authority in Natural History, most authors have adopted his system of classification. He divides osseous fishes (fishes that have a bony skeleton,) into two classes: those which have the upper jaw movable, and those which have the upper jaw solidly fixed to the cranium. The first of these classes he again divides into those having the branchiæ or gills in the form of a comb, and those which have their branchiæ arranged in round tufts. The first of these sub-classes he again divides into those which have their fin rays bony, and those which have soft fin rays. This distinction is commonly known by the bony or spine rayed and soft rayed fishes, and it is one that is easily recognized by those who are only slightly familiar with the subject of Ichthyology. The soft rayed fishes are divided into two or three classes, which it is unnecessary to notice here. Agassiz attempted to classify all fishes, both the varieties long since extinct, as well as the living species, by the structure of their scales. Those having scales consisting of enamel only, he called Placoidians. Sharks and Rays belong to this class. Those having scales composed of a bony substance and covered with enamel he called Ganoids, embracing among its living species the Sturgeon and Gar Pike of North America. These two orders, he says, "were numerous at the remote geological epoch before reptiles were created, and consisted of many genera with species of great size, and that the types of these ancient fishes were reduced to a very few genera."

Ordinary ossified fishes he divided into two orders: the Cyloids, having scales consisting of simple layers with regular outlines, and the Ctenoids, having rough scales with their edges serrated. There are other differences between these orders which we will not notice because this system of classification has been shown to be an imperfect one, and is not generally regarded by Naturalists.

Dr. Theodore Gill, in his admirable treatise on Pisciculture, with reference to American waters, divides all fishes into four principal groups. All fishes having an ossified skeleton, without any regard to the formation of the scales or fins, or other differences in their organizations, he places in a group by themselves and names them the Teleosts. The second group corresponds to the Ganoids of Agassiz. The third group he calls Elasmobranchiæ, on account of the struc ture of the gills. It includes both Sharks and Rays, and corresponds with the Placoidians of Agassiz. The fourth group comprises the Dermopter or Lampreys.

The second, third, and also the fourth groups, we shall pass by without notice. Most of them are represented in American waters, and some of them furnish fresh water types which are undoubtedly worthy the attention of the pisciculturist. Many of these varieties are esteemed for food in some countries, and could doubtless be successfully cultivated and thrive in waters where other fishes would not live. But I am not aware that any effort has been made to domesticate them in our waters. The Teleosts furnish so great a variety of forms, suited to so great a diversity of waters, that it is unnecessary to go outside this group to find ample material to occupy our attention. We have already alluded to the general classification of fishes. It will be useless for our present purpose to discuss this general classification more particularly. The books are full of technical terms which it is difficult to simplify and make intelligible. Thus we have in the United States not less than twelve characteristic types of fresh water fishes, some of which are numerously represented in our New England lakes and rivers, others sparingly, and a few not at all. These are called by names which, to the ordinary reader, serve rather to embarrass than to aid his understanding, and are only expressive in a scientific view. In short, then, all fishes belong to one or the other of two kinds, bony or cartilaignous. Owing, however, to wide differences in their structural organization, all fishes or, at least, all fishes which have value to mankind as food, are divided into groups or orders. These are again divided into families whose general conformation is similar, and all the members of which resemble each other in some important particular. These families are again divided into species, all resembling each other, or having something about their organization in common, and yet each one differing from all the rest in size, habit, or some peculiar characteristic. For instance, we have the White Fish, the true Salmon, the great Lake Trout, sometimes called Mackinaw Salmon and Mackinaw Trout, the Northern Lake Trout, the Sea Trout, White or Silver Trout, the Speckled or Brook Trout, the Arctic Grayling, and the Smelt, with other varieties, all different species, and some of them differing greatly from the others in size and habits, yet all belonging to the Salmon family.

Probably nowhere on the inhabitable globe, unless it be the extreme Northwestern portions of the United States, and the regions adjacent in the British Provinces, has nature so bountifully supplied its waters with valuable fresh water fish as in the New England States, and the lower Provinces of the Canadian Dominion. The memory of men now living runs back to the time when our rivers swarmed with that king of all fishes, the Salmon and its kindred varieties, now, unfortunately, almost extinct within our inland waters. So great, formerly, was the quantity of fish in our rivers that they were a regular and reliable food supply for the earliest settlers, and, together with the pursuit of game, constituted their entire reliance until their farms were in a condition to yield an increase. It is related in *Thompson's Vermont*, that "at an early day, in Tinmouth, in this State, a stream that was about twenty feet wide, containing Trout and Suckers of the ordinary size and number, had a dam built across it, and which formed a pond containing, by estimation, about one thousand acres. In two or three years fish were multiplied in this pond to an incredible number. They were taken by the hand at pleasure, and swine caught them without difficulty. With a small net, fishermen would take half a bushel at a draught, and repeat their labors with the same success. Carts were loaded with them in as short a time as people could gather them up when thrown upon the banks, and it was customary in the fishing season to sell them for a shilling a bushel. And while they thus increased in numbers they became more than double their former size.

This was uncommon, even in those times, but it shows how rapidly fish will increase under the most favorable circumstances. Nature no longer provides circumstances as favorable, but owing in a great measure, perhaps, to causes which are beyond control, our streams and rivers are almost barren of the finer varieties of game fish. Even the Speckled Trout, the most beautiful and the gamiest of all game fishes, has barely escaped extermination. Man, not contented with pursuing and capturing it for food, has encouraged the destruction of the tiny troutlet for no other purpose than the amusement of juvenile anglers, seemingly determined on the entire destruction of its species. I have known fathers to commend their boys for catching young trout just for fun, and throwing them away as if they were a pest and a nuisance. Man has done more than this. Ignorantly, perhaps, but none the less effectually in the way of extermination, he has introduced the bold and fierce Pickerel, that

"Tyrant of the watery plain,"

into waters where it never would have abounded but for man's aid. This has resulted in the complete extermination of all the Salmonidæ in those waters, and in their becoming stocked with Silurids and Cyprinids, or, in other words, with the hideous Catfish species, and the different varieties of the Carp family, which are mostly unworthy of the notice of the pisciculturist, and of no account except as food for other fish. Yet in spite of all, the Speckled Trout has not yet become extinct, and the fact that it still lives and flourishes, in the face of all these discouraging circumstances, proves that there is none hardier, and that with a moiety of care and protection, our ponds may again swarm with this beautiful and valuable fish, and that it may again approach to something near its former magnificence. At any rate, our streams are so barren that it is not probable that any of us will ever be flattered or tempted in the same way that St. Kevin was. It is related in the legend that he lived on the fish he caught in Lake Glendaloch. Upon a certain occasion, having had excellent luck in filling his basket, a celebrated beauty having observed his good fortune, saluted him with this bit of poetry:

"You're a rare hand at fishing," says Kate,
"It's yourself, dear, that knows how to hook them;
But when you have caught them, agrah,
Don't you want a young woman to cook them?"

Scientific inquiry, aided by intelligent observation, has developed in a great measure the nature of the causes which have contributed to the decrease of fishes in our streams, and has suggested remedies for the prevention of further decrease, and methods which it is hoped will re-populate them. The great natural cause of this decrease is the immense diminution in the volume of water. Probably there is not ordinarily in the streams throughout New England, at the present time, more than one-third the amount of water that they formerly discharged. This, of course, is beyond our control, and without the limit that can be reached by legislative action. But if some of these causes are without this limit, others are within it, and are the proper subjects for remedial statutes. The building of mill-dams across our streams without suitable fish-ways over or through them; the introduction of poisonous substances into the waters from manufacturing establishments; the cruel and wanton destruction of young fish, and the introduction of Pike and Pickerel into waters where they do not now exist, are all matters which law can reach and prevent. A case has recently been decided by the Supreme Court of the United States, which establishes a principle, as it seems to me, which has interest for Vermont farmers, and also genuine sportsmen everywhere. A few years ago the Legislature of Massachusetts passed an act providing that a fish-way should be built across or around the dam over the Connecticut River at Holyoke, and appropriated a part of the amount necessary to complete the work. The owners of this property refused to obey the law, and contested its constitutionality before the Courts. Beaten before the State Courts, they appealed to the Supreme Court of the United States, which has sustained the State Courts, and rendered a decision sustaining the constitutionality of the act, and thus the right of State Legislatures generally to pass similar enactments. Now it seems to me that this decision is of immense importance to the people of Vermont, if they would only use it as they might. Does it not in effect establish the principle that every farmer who has upon his premises water running to the sea, has the right to have that water flow in an unobstructed course, so that whatever of migratory fishes he sees fit to cultivate in his private ponds, may follow out the instincts of their nature and return from the sea to their native spawn beds? This decision, however, will not be likely to prove of much advantage to us unless we make laws for the construction of other fish-ways. But public opinion makes law, and public opinion in Vermont does not yet demand that a fish-way shall be constructed over every mill-dam in the State. Whether or not the interest of Vermont farmers demands this legislation we will not stop to discuss. Certain it is that if their interest does demand it, they will be sure to see it for themselves before many years. And when, this exigency having arisen, the farmers of Vermont demand that such laws be enacted, then, and not till then, will they be enacted and enforced.

But with all the necessary legislation, and with courts and public opinion willing and anxious to make the legislation effective, it is to my mind a matter of very serious doubt whether our public waters could be made as prolific as they once were. Much improvement, undoubtedly, could be derived. But whether the limited water supply which the State now affords would not prove a greater obstacle than all the rest, time must determine. There is, however, one resource left to the pisciculturist—artificial propagation, and confinement in private ponds. All things considered, this is about the only method by which it is now possible to raise fish in Vermont, and has within the few past years called out so much discussion and excited so much attention, that its feasibility or practicability is no longer a matter of any doubt. Experiment has gone farther than this. It has been demonstrated over and over again, that the shy and timid inhabitant of our fresh water streams, in its natural state fearing the very sight of man, and fleeing at his approach, can be tamed and handled and educated. I do not mean that they are capable of being educated to that extent that the higher orders of the brute creation are, but that they can be taught that man is not their enemy, and to come at the sound of a bell; become fond of being caressed, and take their food from the hand. The nature of their organization, and the element in which they live, being in a measure beyond man's control, seems to render this about all that can be accomplished in the way of their education, but it does not prove that they are incapable of further improvement. They have all the five senses of land animals. They possess a bony, a muscular, a nervous, and a circulatory organization. They are not without brains. And, though belonging to the lowest order of vertebrate animals, it will hardly be doubted that many of those varieties which have become familiar to us, possess an intelligence that is equal, if not superior to that of many animals living upon the land.

The discovery of artificial incubation belongs to a French monk, Dom Pinchon by name, and was described in a manuscript dated in the year 1420. It was never published, and remained a secret until a recent time. Lund, a Swede, first invented artificial spawning boxes, but the discovery of artificial fecundation of fishes' eggs was first made by Ludwig Jacobi,a German, about the middle of the last century. In 1763, he published an original paper giving a complete account of the manner in which his discovery could be made practical, and although he himself made a practical use of it with such important results that the fish so obtained became an object of considerable commerce, and he was rewarded by England with a pension; and, although his paper had been translated into French and Latin, and again published in Paris in 1773, yet, strange as it may seem, it was lost sight of for nearly one hundred years, when, a little more than thirty years ago, Remy, an illiterate fisherman, living among the Vosges mountains in France, was found to be experimenting, with the same successful results that naturalists had recorded a century before. He was hailed with all the enthusiasm of a new discoverer, and not without reason, because it is not probable that he could have known what had remained buried among the archives of science for almost one hundred years. His invention had then all the merit of being an original one. Himself and his associate, Gahin, therefore, were loaded with honors, granted medals by scientific societies, and pensioned by the government.

It would not be uninteresting to trace the history of pisciculture in Europe for a few years past. Were we to do so, we should find much that would not only be of profit to those interested in the development of the art, but much curious and entertaining information. We should learn how, encouraged and protected by the law, it has re-populated streams that were becoming almost barren, and introduced the choicest varieties of fish where they were unknown before. We might go yet further away and learn something about how the systematic culture of the waters, yielding enormous quantities of food material, relieves the overburdened soil of China and Japan. Although this would be appropriate to our theme, we must confine ourselves within narrower limits and discuss matters which have a nearer and more practial relation to farming.

It is a very small proportion of the farmers of Vermont who have a ready and convenient access to markets. A fresh roast, a slice of sirloin steak, a leg of fat mutton, or a nice fish is, in the busy season of the year, upon a large majority of their tables, the exception oftener than it is the rule. I know better than to stand here and say that the farmers don't live well. On the contrary, what little experience I have had in thirty-three States and Territories, makes me believe that as a class the farmers of New England live better, as regards the supply of healthy and nutritious food upon their tables, than any other class. The produce of their dairies, their poultry, and their gardens, and the qualities of this produce, make their living in some respects luxurious. But, ordinarily, there is this disadvantage among farmers' cuisines to which I have alluded. For strength and courage to labor, through the hot harvest months, he must rely upon the inferior salted and preserved meats and fish. Without alluding to the cost of meats let us consider for a moment the prices we have to pay for fish. With all our railroad transportation and but little over one hundred miles from the sea coast, we pay from six to ten cents per pound for both fresh and salted Cod, the commonest and cheapest of all fish! The coarse Halibut, both in summer and winter, costs us from ten to twenty cents per pound! For fresh Mackerel the same price. We must pay twelve cents per pound for salted Salmon and Mackerel. And for fresh Salmon from forty to fifty cents a pound. Half a dollar a pound for fresh Salmon, when you can raise your own Trout for five cents a pound! Fifteen cents for a pound of Halibut, when you can raise fresh fishes, infinitely more palatable, at less than one-quarter the expense! The idea of trying to compare the salt water Halibut with the fresh water Trout as a food fish would be almost ludicrous. Among the whole list of edible fishes, the different species of Salmonidæ stand superior to them all as regards fineness of texture, their delicious flavor, or their wholesome and nutritious qualities; and they are nearly all fresh water fishes, at least the varieties that are not purely a fresh water fish are migratory in their habits. Now seven-tenths of the farmers of Vermont can raise their own fish, and at comparatively small expense. A tenth part of the money it costs to start a flock of sheep, and a twentieth part of the time and trouble it takes to care for them, spent upon the common Trout would, I apprehend, yield a much greater profit. A moiety of the money and time and talk some farmers spend with their horses, expended upon fish, would pay them much better and in more ways than one.

Seth Green, one of the largest and most successful pisciculturists in the country, says: "All the waters of this country can be filled with fish adapted to them. Every acre of water is worth two acres of land if properly farmed. Most persons suppose that it can be done at trifling expense. It can be done cheap, but it cannot be done for nothing. Spend one-thousandth part of the sum spent in tilling the land in cultivating the water, and fish may be sold in our markets at two cents per pound."

This would seem to indicate that Mr. Green believes that fish can be raised in private fresh water ponds at so small an expense as to compete with salt water fisheries. The one-thousandth part of the sum which some farmers expend upon some acres of land would be rather a small capital with which to commence the business of fish culture. Mr. Green as a pisciculturist is, with all his valuable experience, an enthusiast, and it would not be strange if, with all his enthusiasm, he is sometimes extravagant.

However true his remarks may be, as applied to some sections, it is evidently out of the question here with our present laws. But that Vermont farmers, with no other laws than are now in force, can, with a moderate outlay, raise their own fish, is beyond any doubt. Perhaps some of you think it is easier to say this than to tell how it is done. Let us see. The first necessary requisite is an unfailing supply of pure, clear water. The softer and more equable in temperature the better. Springs are preferable, and, in fact, they are indispensable for those who breed artificially, because the water must not freeze in winter. Small streams, however, can be made available, provided they are reliable in dry weather. Large streams are also serviceable, but the expense of excavating the ponds and guarding against freshets is, of course, greater.

I cannot do better than to quote from the simple directions of Theodore Lyman, one of the Commissioners of Massachusetts:

"The simplest hatching apparatus, without a house at all, and one at the command of anybody, is made as follows: Close below a spring head, dig a trench a foot wide, so that the whole water shall pass though it gently. Fit tightly into this trench a box, four feet long, and open above and at each end. (The water will now flow through this.) Close the upper end of the box with a layer of coarse sponge, and below this (down stream, that is) add two flannel strainers stretched across the box. (Now the water will still flow, but will be filtered.) Close the lower end of the box with a metallic gauge—the bottom of an old sieve painted will do—and add a movable cover on top. Now you have a closed box or trough through which a stream of filtered spring water flows constantly.

"Take gravel the size of peas, wash it till clean and spread it one inch thick on the bottom of the box. On this gravel lay trout eggs so that they do not lie on the top of one another. Examine them daily, to remove the dead ones or any dirt, and wash the filters when necessary. They will all hatch when they get ready. * * After three or four weeks two dark specks appear on each egg, and these, when held to the light, are seen to be the eyes of the embryo, showing through the translucent shell. This is a good time to pack eggs for transportation. The tiny embryo may be seen jerking itself uneasily in its spherical prison, a movement that continues to increase until, after two or three months from impregnation, according to the temperature of the water, the creature bursts its shell and appears in all its grandeur, looking, to say the truth, more like a spiritual polliwog than a real salmonidæ. This polliwog character arises from the great yolk sack, or rather call it haversack, for it bears the thirty days' rations of this recruit. All that time he lies still, without foraging, but thereafter we must issue to him, for now he appears as a genteel minnow, with bars on his sides. Twice or thrice a day a little clotted milk, rubbed very fine in water, must be put in the trough, and the fry may be seen eagerly to swallow the floating particles. With enough food, room and water, they will grow fast and will take larger and larger morsels. At a year old, they may very well weigh four ounces, though they may be somewhat larger or much smaller, according to their treatment. Their increase will depend upon depth of water and quantity and variety of food."

Mr. Lyman also gives full directions as to the way in which spawn may be procured and the manner in which they may be impregnated. If you wish to try your hand at artificial impregnation, the books are full of directions and theories which seem to be simple enough and easy to put into practical operation. But it would be well to visit some fish breeding establishment, and there are several within a few hours' ride, where, for a small sum, you can become initiated into all the mysteries of the art. And in pisciculture, as in everything else, a little practice is worth a good deal of precept. If, however, you are anxious to do a little something at fish culture as an amateur, you will probably purchase a small quantity of ova at some one of the numerous fish establishments scattered through the country much cheaper than you can obtain it yourself. You will procure ova impregnated and warranted at from seven to ten dollars per thousand, and larger quantities at a less price. Or, if you do not have the facilities for hatching, wait until May or June and purchase the young fry. These will cost you from twenty to thirty dollars per thousand. The season to purchase spawn is during the winter months; young fry can be obtained at almost any time, but the spring and autumn months are the most favorable for moving them without injury.

It would be difficult to estimate the profit which farmers might realize from this new branch of industry, after their ponds were constructed and their young fry procured. The matter of furnishing them with sufficient food would, of course, be the largest item of expense under favorable circumstances; this item for a family supply of trout would be trifling, because they would consume and thrive on much that would otherwise be thrown away. At a meeting of the Fish Commissioners of several of the States, held in New York, October 19th, 1872, Dr. Goldsmith, of Rutland, one of the Vermont Commissioners, "called the attention of the meeting to a matter which concerned more especially those separated from the sea and with whom fish culture must relate to fresh water fishes only; such as trout. The question which had been presented to his mind was one which is important in the economy of fish culture. How many pounds of fish food, muscular fibre, does it take at a given temperature of water to produce a pound of trout? And what, with a given cost of food, is the absolute cost of a pound of trout, the first, second and third years of feeding? He said he had made some experiments in this direction himself, and he desired to bring the matter to the attention of the meeting, with a view to secure some experiments by others living in different parts of the country, for the purpose of determining this fact and thereby settling the question whether fish culture is profitable or simply a congenial amusement. He therefore moved that the United States Commissioner of Fish and Fisheries be requested to address a letter to such persons as are now engaged in the culture of trout, which shall contain recommendations from himself and which shall secure the careful performance of the necessary experiments and prescribe the methods by which the questions shall be determined. This motion was agreed to."

Although this meeting was something more than three years since I have not yet been able to learn whether or not the experiments have been made. If they were made and the information obtained, it has not yet been published to my knowledge. The result of these experiments would, of course, be interesting to those farmers who wish simply to raise their own fish, but they would have a more practical relation to those engaged in raising fish to sell in the market. I suppose there are few farmers who, when they sell their poultry or their beef and pork, can tell exactly what it costs them to raise it, or the profits which they have realized from its sale. We can, with our present means of information, estimate the cost of raising fish fully as accurately as we can the cost of beef, pork and poultry.

Now we will say that you have a spring of water on your farm, or a brook from which you can draw into your ponds the water that will run through an inch pipe; you have constructed your ponds thirty feet long by ten feet wide, capable of holding two and one-half feet of water, and have determined to experiment a little as an amateur pisciculturist. These ponds are suitably divided into compartments amply sufficient to hold four thousand trout. You have purchased each year for four years one thousand spawn, at the average price of eight dollars per thousand, and have hatched and reared them successfully. In addition to the bits from your table, curds, sour milk and an occasional supply of food for them from the animals you have killed, you have purchased twenty-five dollars' worth of refuse meat. This is a large estimate, but let us make this side of the account as large as it will possibly bear. The labor and time you have expended in taking care of your trout and in fitting up your ponds has been but trifling, and you have been amply repaid for all this in the pleasure you have experienced in seeing them thrive under your treatment. Your total cash outlay for four years has been fifty-seven dollars. Now what ought you to have in your ponds to offset this? You will have one thousand three year olds, weighing at least one and one-half pounds each; one thousand two year olds, weighing at least three-fourths of a pound each; you have two thousand two hundred and fifty pounds of trout which, at the present prices, is worth in the market and will sell for six hundred and seventy-five dollars. In the summer time it is worth as much as fresh Salmon, and that is worth from forty to fifty cents per pound. Reckoning it at forty cents, it is worth nine hundred dollars. Then you have, in addition to this, one thousand yearlings, which are worth at least eighty dollars, and one thousand small fry, which are worth twenty dollars more.

Calling your trout worth only twenty cents per pound, your fifty-seven dollars has proved a profitable investment which has brought you property worth five hundred and thirty dollars. Supposing, for some cause or other, one-half of your fishes die or are stolen by somebody's neighbor's boys, or that they do not grow to more than one-half the size you expected they would—even then your fifty-seven dollars has yielded you a return of more than four hundred per cent. So, looking at the matter from whichever way you will, you must, I think, see that the statement, which some one has made, that fish culture pays a profit of one thousand per cent., or that fish can be raised and sold in our markets for two cents per pound, are not altogether wild and fanciful statements.

The net profits of trout propagation at the establishment of Mr. Green, in Livingston county, New York, were one thousand dollars in 1866, five thousand dollars in 1867, and ten thousand dollars in 1868. The property where his ponds are located was purchased a few years ago for two thousand dollars, and, when his operations had fairly commenced, he accepted a proposition for six thousand dollars for a half interest in the works.

Stephen C. Ainsworth, the pioneer pisciculturist of this country, says that with a good spring of one-half inch of water, one may raise all the trout he needs for his table with trifling expense. Dr. J. N. Slack, of New Jersey, regards pisciculture as no longer an experiment, but as a pursuit quite as certain as agriculture, and, at present, much more profitable. So I might quote page after page, not of opinion and theory only, but of practical result. But I am already, I fear, trespassing upon time which has been allotted to others. The earth, long cultivated, loses its power to produce crops; but the inexhaustible supply of water, which a wise Creator has given us, like the air we breathe, never loses its vitality. Rightly cultivated, it increases in its power to sustain animal life. Here is a field wide enough for intelligent experiment and observation, as well as scientific investigation, not yet half explored. It offers the farmers of Vermont splendid opportunities. I am well enough aware that I have not begun to do this subject the justice it demands. If, however, I have succeeded in awakening any interest in an art which, as allied to agriculture, has an importance just beginning to be appreciated, I am amply repaid.

MISTAKES OF FARMERS.

BY S. G. BUTLER, OF ESSEX.

Centuries ago, a certain wise man uttered this proverb, "There is that is destroyed for lack of judgment." The centuries that have since passed have witnessed great and marvelous advances in all departments of human knowledge, in literature, art, science and religion, in methods of labor and business, but the most casual observation of the field of human pursuits and industries would justify the reiteration at the present day of the same saying. Indeed, frailty in plan, purpose and execution characterizes men—all men in all pursuits and professions. Especially is this true of farmers as a class, so many of whom find their income sadly small and insufficient, from "lack of judgment." The first mistake of the farmer I wish to notice is—a lack of appreciating the dignity, honor and usefulness of his calling and labor.

The man who regards his calling as low and disreputable will not increase in self-respect, or any good moral quality—he will naturally resort to unworthy means to secure vile ends. Any approximation to this view will show corresponding results. One engaged in a mean pursuit will likely feel mean and act mean. Somewhat of this feeling, no doubt, pertains to farmers, many of whom esteem their calling low in comparison with other pursuits—and yet what occupation can be more honorable or useful?

Why, the first man God made was a farmer, and, had it not been for his unwise desire to go into some other business, this world would have remained an Eden forever.

Labor itself is not a curse. The Indian who defined original sin to be "laziness" was not far wrong. Laziness is a curse the whole world over, but well directed labor never. It is always useful and honorable—now, as well as in Eden. Yet how many seem to regard it as degrading—especially farm work—and despise it.

Recently, in one of our cities, it is said, eighteen persons answered an advertisement for work in a store and four hundred for a gentleman to travel and play the banjo.

The second mistake I wish to notice is—not seeking and obtaining a higher and better education.

The day is passed when the old saying was current—any fool will make a farmer. It is true—thanks to a beneficent Providence—one may raise good crops who is not acquainted with either Greek or Latin, and is quite ignorant of the processes of nature which result in his growing crops; but the fact is equally true—the more knowledge, research and brain one concentrates in his work, the more successful and perfect will be the results of such labor.

A machine may plant corn, but it is the brain that developed the machine and guides its work.

Farmers ought to be as well educated in the particular branches which relate to their work as persons in other callings. What would be thought of the physician who failed to acquaint himself thoroughly with the various diseases, their symptoms and remedies, for which he is called to prescribe? What would be his success at the present day if, in such an emergency, he could avail himself of only the common remedies which prevail among gipsies and fortune tellers or such as have been handed down by tradition?

Persons in all other professions are expected to obtain a thorough knowledge of the branches of study which relate to their work. To this end they provide books and papers, constantly enriching their minds with the best thoughts of the best minds, and availing themselves of the wisest suggestions and methods. Equally urgent and imperious is the demand that the farmer, who might have equal facilities for the purpose, be well versed in the knowledge relating to his work, in those branches of science which relate to the farm.

He should secure agricultural papers and books, observe and examine carefully the conditions, influences and facts which bear upon the various operations of the farm—be constantly increasing his store of knowledge and always solicitous to secure the best results by the adoption of the best methods.

Who can doubt that if the time uselessly wasted in lounging about the tavern and store, in story reading, or in other ways, was employed in the manner just indicated, or the money worse than wasted was turned into this channel—who can doubt that farmers would be more skillful and successful in their labors, or that there would be less occasion for complaint?

I have said that farmers should have a better theoretical and scientific knowledge of farm work. Now, it is a sad fact, I think, that not more than one farmer in ten is a subscriber to an agricultural paper, or reads or owns an agricultural book! How many farmers, think you, in any given territory, can tell what are the constituents of milk, or describe, even tolerably, the chemical changes which occur in the rising of cream, the process of churning and the production of butter?

It is said that only about one tub of butter in ten sent to market will rank A No. 1. Have the two facts no connection? If the science of butter making was better known, who can doubt that the quality would be improved?

A third mistake is in the wastes of the farm. A wide field for discussion opens here, but I can notice only a few of these wastes.

The loss to the farmer from evil habits is enormous. The farmer who spends needlessly five cents a day will lose enough in fifty years, with the accrued interest, to buy a five thousand dollar farm; if he spends ten cents per day for the same time he will suffer a loss of ten to twelve thousand dollars.

It is estimated that at least one-fourth of all the manure made is lost yearly by exposure to rains, evaporation and injudicious application.

The loss of all crops from insufficient preparation of the soil, sowing and planting and after care in culture and harvesting; the loss of nutrition in the hay crop on account of unseasonable cutting and curing, and the consequent decrease of flesh in animals consuming it, and the returns they yield; the loss of hay fed where it is trampled upon, and this item alone is enormous; the loss from insufficient care and shelter of stock and of farming tools and implements; from insecure fences, from lack of suitable and timely repairs of buildings, from the inferior quality of the products of the farm—the loss from these sources alone must be, in each particular, of great magnitude, and, in the aggregate, almost beyond computation.

Another mistake is—not making home and farm work more attractive.

Home should be the most pleasant place in all the world—so many ties centre there. Why should it not be attractive, cheerful and happy? The dwelling and all its surroundings should be, as far as possible, neat, tasty and inviting, such as to charm the eye and hold the heart. Good books, papers, pictures and music should be provided—these are indispensable requisites in the education of the mind and culture of the affections and taste.

Suitable implements for farm work should be provided, and suitable hours for farm labor only should be required. But how often is the exact opposite of this witnessed among farmers. The dwelling is dilapidated and cheerless, the parents cross and sour-visaged, the dress is untidy, the work severe and exacting—it is hard work early and late. Kind words are seldom heard, and but few attractions bind the heart to the home. Reared in such circumstances, do you wonder so many acquire a disrelish for the farm?

Again—it is a sad mistake to run in debt for so much land. I do not refer now to those who, from small beginnings or otherwise, have come to a competency, and prefer to invest their accumulations in real estate rather than in other directions, but to those who, without sufficient means, take upon themselves burdens which they are not able to bear, and which will only prove ruinous. I mean those who are afflicted, in this respect, with what some one calls, almost profanely, "damphool on the brain." They have a mania for buying land, and, as a noted man once said, "if a person owned the whole world, he would still want a piece outside of it for a potato patch." So these add field to field. To meet their oft, and inevitably recurring payments, they strip the land of its forests and the meadows of their fertility, spend toilsome days and sleepless nights, deprive themselves of ease and comfort—sacrificing the life, perhaps, of the faithful wife, and their own happiness—for what? The poor compensation of paying heavy taxes on land they really do not own, and a large amount of interest on what they owe. It is estimated that farms are now paying not more than three or four per cent. on the capital invested.

If this view is correct, the goal of solvency must be far distant,by the ordinary operations of the farm, to those who are largely in debt. The prospect, to a sober judgment, can hardly be enchanting. The evils this practice brings to individuals and families in the greater temptations to be dishonest, and the fraud it induces, the intolerable burden of care and toil it imposes, and the consequent premature senility and loss of life it brings, and when generally adopted, the absorption of smaller estates, and the dispersion of households resulting thereby, the isolation of families, the breaking up of schools, the loss to the church and State, and various other evils connected with this practice, I have not time to notice now.

> "Ill fares the land, to every ill a prey,"

where this evil prevails. Our farmers are already overloaded with debts. So are our towns and States. Some warning voice should be raised to stay, if possible, the ruin. Is it not true that one of the most fruitful causes of uneasiness, complaint, anxiety, distrust, ill temper, and much of domestic infelicity, among farmers at the present time, is *the heavy burden of debt* that hangs about their necks like a millstone, debts that are ever recurring and ever pressing?

SOME EXPERIMENTS IN THE HYBRIDIZATION OF CEREALS.

BY C. G. PRINGLE, OF CHARLOTTE.

When agriculture shall have been long enough to school to the natural sciences, and, under encouragement from the State, and under the lead of intelligent and devoted patrons, shall have taken its true rank among the pursuits of man, keeping pace with the progress of the world, and holding its own against the aggressions of every other interest, perhaps no art, of all those which it will make contributory to its use, will do it greater service than the one which I bring to notice to-day.

Then hybridization, in the hands of those who will devote their lives to its study and practice, will be in constant requisition to furnish to the cultivator in field, garden and forest such plants as will best supply his wants, or gratify his fancy. Instead of being employed as now by a few scattered experimenters, and very much as we handle some magic toy, to amuse or astonish us by its unexpected or brilliant displays, it will in that day be practiced systematically and judiciously to produce sure and definite results. None of the higher orders of plants, upon the cultivation of which man bestows any attention whatever, but will be made to feel its potent influence. Fruits and vegetables, flowering and foliage plants, cereals and grasses, herbs, shrubs and trees,—everything, from the tiny growth that contents itself with a three inch pot, up to the monarch of the mountain forest,—all these myriad vegetable forms, lying plastic as clay in the hands of the experimenter, shall be made to exhibit manifold variations never before seen, and not as yet conceived of.

That there are certain limitations imposed upon the work of the hybridist, that there are absolute boundaries appointed to genera, if not to species, beyond which he may not in all time push his modifications of the original type, is not to be denied. But how broad these boundaries are, what may be the utmost limits of variability of each species, how many and what species of any genus may be blended in the permutation of endless variations, what genera, even, as they are now received, he may have the boldness to undertake to unite,—all these innumerable questions await solution by the tireless experiments of a long future

In thus predicting for my art so glorious and beneficent a career, I am not giving expression to some groundless vision, conceived in the imagination of an enthusiast, but I reason from what I have seen as a practical hybridizer, and from the splendid results which have followed the desultory efforts of the few who have entered this field. The advance already made in Europe justifies this belief. The superiority of the horticulture of the nations of Northern Europe over our own, is not all to be attributed to their older civilization, their greater wealth, or the patronage of govern-ments paternal in form, but is in great measure due to the assiduous labors of sagacious hybridizers. On the fruits of those labors have we been paying a premium. But now we have begun to send back, to cancel our debt, the product of our own hybridizations.

From the president's chair of the American Pomological Society, Mr. Wilder, himself one of our earliest and foremost hybridizers, omits no opportunity to urge upon the horticulturists of America the importance of the practice of this art. "Plant the most mature and perfect end of the most hardy, vigorous and valuable varieties; and, as a shorter process, insuring more certain and happy results, cross or hybridize your best fruits, flowers and vegetables," he urges repeatedly.

The difficulties which oppose the artificial fecundation of the cereals, may doubtless be assigned as the reason why these plants, although holding the very first rank in respect to usefulness to man, have been so little made the subjects of experiment by the hybridist. Probably nearly all the limited number of varieties of wheat, or oats, or rye, or barley, which we possess, are of accidental origin, if we may so designate those results which were produced by the operation of natural causes, all without the intentional intervention of man. New forms appearing in his grain fields have caught the attention of the farmer, have been preserved, propagated and disseminated. Possibly some of these new forms may have sprung from cross-fertilization, effected under some rare combination of circumstances, by the agency of the wind, or of insects. Some of them may have been due to that freak of nature in reproduction which we call "sporting," wherein like does *not* produce like. Others, again, may have been at first only modifications of the ordinary type, effected by peculiar external conditions, which divergence may afterwards have been increased and made permanent by selection and high culture. But here I must record my conviction that many, if not most of these new varieties of grain are not new except with respect to the place in which they come to notice. They are old varieties estray, by some chance, from remote quarters, it may be, of the globe, older, perhaps, than the nations which they have nourished, propagating themselves for years in obscurity, migrating hither and thither in numerous ways, until picked up at last by some enterprising cultivator, carefully fostered, and sent forth with a new name.

The instances where man, though he possesses in cross fertilization the means of producing new varieties at will, has made use of this means to accomplish any definite good, are extremely rare. Although myself engaged in such experiments, I must confess that I know of but one other similarly employed, my friend and correspondent, Charles Arnold, of Paris, Province of Ontario, who has addressed himself, with eminent success, to the crossing and re-crossing of wheat (always winter wheat, I believe), and has produced varieties which meet with much favor in cultivation.

A wide and deep interest has recently been shown in agricultural circles in England, in some experiments for the improvement of wheat, carried on by Major F. F. Hallett, of Kemp Town, by which quite astonishing results have been attained by selection associated with high cultivation, In one case, commencing in 1859 with an ordinary variety, whose best head was four and three-eighths inches in length, and contained forty-seven grains, by giving it good soil and ample room, and by selecting for seed the best head of each annual product, after but four consecutive years, Major Hallett obtained a head that was eight and three-fourths inches long, and contained one hundred and twenty-three grains. Surprising as is this improvement, which affords a useful lesson upon the importance of selecting seed, it is not to be conceded that the advantage thus secured will be permanent, or that a new variety has been produced. Only a highly bred form of an old variety, Hallett's "Pedigree Wheat" must rapidly revert to that identical type, unless the care which produced it be systematically maintained.

I have introduced this account of Major Hallett's experiment to aid in illustrating the superior advantages possessed by hybridization followed by selection over selection employed alone. Had Major Hallett begun by crossing judiciously a few of the very best varieties of wheat within his reach, he would have had as the issue a large number of forms, some of which, undoubtedly, by combining the desirable characters of the parents, to the exclusion of the inferior ones, would have been much superior to the original sorts. Thus at the start he would have taken a long stride in advance; but crossing would have given him another advantage. His young varieties, possessing greater mobility than the old varieties, whose character, by unvarying transmission through many generations, had acquired great stability, would have yielded far more readily than these to the ameliorating influences afterward to be employed. If, then, he had applied to these new gains his principle of selection, and, when he had developed them to their utmost capacity, had again operated among them cross-fertilizations, and so on through a term of years, occasionally crossing his subjects, and always practicing upon them selection, can we doubt but he would have obtained results which for diversity and excellence it were impossible to eclipse?

But there is another advantage to be placed to the credit of hybridism which I have not brought to light in this comparison. I allude to the fact, familiar to all breeders of animals as well as hybridizers of plants, that increased vigor is often the direct result of crossing among individuals of a variety or varieties of a species, just as surely as too close inter-breeding tends to the opposite effect. So abundant concurrent testimony did Mr. Darwin find upon this point, that he announced the principle that cross-fertilization between the varieties of a species is the plan of nature, and is practically so universal that no hermaphrodite species continually self-fertilized would continue to exist. With regard to this principle, Dr. Asa Gray, in a recent paper on the question: "Do varieties wear out, or tend to wear out?" says: "If it be asked how the asserted principle is proved or made probable, we can here merely say that the proof is wholly inferential. But the inference is drawn from such a vast array of facts that it is well nigh irresistible. It is the legitimate explanation of those arrangements in nature to secure cross-fertilization in the species, either constantly or occasionally, which are so general, so varied and diverse, and we may add so exquisite and wonderful, that, once propounded, we see that it must be true."

* * * *

How and why the union of two organisms, or generally of two very minute portions of them, should re-enforce vitality, we do not know, and can hardly conjecture. Now, from all observations upon the fecundation of the cereals, and of the other genera of the order of grasses to which they belong, we are led to believe that close self-fertilization is the law of the order. Impregnation of the ovules is accomplished "within closed doors" before the nicely fitting glumes and palets open to unfurl to the mid-day breeze the emptied stamens. Hence, in view of the principle which Darwin deduced from the discoveries of those sagacious experimenters, Kölreuter, and Gärtner, and Knight, and Sageret, and Wiegman, and Naudin, and Lecoq, and Herbert, and which our own Gray so fully accepts, may we not expect to gain from cross-fertilization, in operations upon wheat and other cereals, if anywhere, increased vigor in the offspring? And, accompanying increased vigor, we should find greater hardiness and productiveness. Two instances in point are on record: "Mr. Maund exhibited before the Royal Agricultural Society [1846,] specimens of crossed wheat, together with their parent varieties; and the editor [of the *Society's Transactions*,] states that they were intermediate in character, united with that greater vigor of growth, which, it appears, in the vegetable as in the animal world, is the result of a first cross. Knight also crossed several varieties of wheat, and he says 'that in the years 1795 and 1796, when almost the whole crop of wheat in the Island was blighted, the varieties thus obtained, and these only, escaped in this neighborhood, though sown in different soils and situations."—*Darwin*, *Variation*, chap. xviii.

To these may be added another furnished by the experiments of Mr. Arnold. A committee appointed by the Board of Agriculture of Ontario to examine his cross-bred wheat, reported that all the varieties had stood the winter well, quite as well as one of the parents, and much better than the other, and that the heads of the new varieties were much larger than those of the parent kinds.

With these introductory remarks upon the hybridization of cereals, I will proceed without further delay to detail my own experiments in this field. It was in 1870 that I operated my first cross-fertilization of wheat, impregnating a few ovules in a head of the Black Sea variety with pollen of the Gold Drop or Siberian. I chose the Black Sea as a mother plant or seed-bearer, because of the reputation it maintains as one of the very hardiest varieties ever in cultivation in this country; one that will the most successfully withstand the attacks of insects and fungus, endure ill treatment at the hands of the farmer, and, even in unfavorable seasons, give good harvests. But while so much may be said in praise of the variety, it must be admitted that the quality of its flour is below the average; because of this fact I fertilized it with the Gold Drop, which is superior in this regard, and excellent in all respects; seeking to unite with the hardiness of the one the finer quality of the other. The fruit of this cross, a half dozen grains, was sown the next spring, in a drill, and cultivated with the utmost care. This first year the several plants showed great uniformity of character. They were, speaking in a general way, intermediate between their parents. Except for a few short awns on the upper part of the heads, they were beardless like the Gold Drop, though they had sprung from seed borne on the

Black Sea, a full bearded variety; the chaff had taken a reddish tinge from the Black Sea; and the kernels were larger, plumper, and of lighter color than those of that variety, evidently partaking strongly of the character of the Gold Drop. Great vigor was displayed by the plants, and the heads were of unusual length. Possibly this great vigor was in part due to the good effect of crossing; certainly good cultivation had something to do with it.

The selected product of these plants was the second spring sown in drills and kept separate by numbered stakes. As the plants grew luxuriantly and tillered freely, I counted on a rapid increase of my stock of these new varieties, which, judging from the character they exhibited the previous year, would, beyond question, be valuable gains to agriculture. But as the heads issued from the sheath of the upper leaf, great was my astonishment and dismay to observe among the plants of each class a wide diversity of forms. There were heads of various lengths and of many forms; there were awnless heads, and heads bearded in every degree. As the other characters, those belonging to the kernel, developed, it became manifest that the several characters of both original types were jostling together in complete confusion. Reversion was playing its part; and, struggling against inheritance, was gaining for certain characters the ascendency in one plant, while in another it was giving the advantage to those quite different. It was apparently seeking to resolve the hybridity I had effected, and to carry back a part of the plants to one parent form and a part to the other. That it did not in some instances completely succeed in this, showing me from this union resolved the Black Sea and the Gold

Drop pure again, I cannot deny. Usually, however, it failed to gather up again all the characters peculiar to either type, so effectually had hybridization segregated them and dispersed them through the direct offspring of the cross, the plants of the previous or first year, and was compelled to leave them scattered irrecoverably and entering without law into new combinations innumerable.

When I saw this medley among my crosses, I relinquished my expectation of speedy advantage from the experiment; and, but for the aid which selection offered me, would have remitted altogether a work involving so much of care and patience, and yielding such perplexity and disappointment. Selecting, however, a few of the most distinct and promising forms, and beginning again the third year, with the product of single plants, as before, planting in separate drills, and if any sporting appeared in the drill, as was almost invariably the case, though the degree of variation became less and less, selecting from the drill in such event the best plant, the one which approached nearest the ideal appointed for that drill, to yield seed for the next year, I have succeeded, after four years, in fixing the character of several varieties. The sway of inheritance in them is no longer disputed, and they come true from seed.

No. 6 is a bald, red chaff variety, with its kernel small, scarcely longer than broad, and very tawny in color.

No. 7. Bald; red chaff; kernel large and plump, reddish.

No. 9. Bald; chaff nearly white; kernel large, red, very plump.

No. 13. Bearded; white chaff; kernel large, oblong, rather light colored.

No. 15. Bearded; red chaff; kernel large, plump, dark.

No. 15½. Bearded; white chaff; kernel of good size, almost spherical, not deeply colored. Assorted from No. 15; only three years ago the two sorts were contained in one kernel.

It is interesting to trace each of the several characters of these six varieties to its origin, either in the Black Sea or the Gold Drop. I will add that all these new varieties are remarkably vigorous and productive, carrying heads from five to six inches in length. All have resisted mildew or rust the past year.

In 1871 I renewed my crossing of cereals, operating upon wheat, oats and barley. A friend brought me a foreign variety of wheat, the White Hamburgh, with kernels of milky whiteness, giving every indication that they would yield flour of superlative excellence. At once I seized upon this variety as just the pollen parent I needed to give to our hardy sorts of spring wheat the fine quality possessed by our white winter wheat. I presumed that this wheat, as is usually the case with our imported cereals, might not succeed in our soil and climate, and that the only way to make its excellence available in our agriculture was to impart it by hybridization to our common hardier stocks. My apprehensions respecting the unfitness of this White Hamburgh wheat for our climate have been verified, I think, for with me it has always rusted before the seed was fully formed; and for several years past I have seen in our agricultural journals no mention of the variety. But that year my plants came into bloom successfully, and furnished me with an ample supply of pollen. The heads of this variety were of medium length, but the spikelets were crowded upon the rachis in a manner I had never seen equalled. I recognized this at once as an additional character of merit, which I could employ to render more close the loose heads of some of our old varieties. The Berlin wheat, once known as the Rio Grande, I believe, and lately disseminated anew under the name of the Dodge wheat, whose heads are remarkably long and loose, I impregnated with the White Hamburgh to this end. To be most certain of securing the fine quality of the White Hamburgh, I applied its pollen to the stigmas of the Gold Drop, which already possessed that character to a good degree, and to those of the Michigan Club, a similar sort.

The progeny of these several cross-fertilizations fully vindicate the correctness of my designs. The behavior of these later cross-breeds has been identical with that of the crosses between the Black Sea and the Gold Drop, already described so particularly. The same intermediate state between their respective parents the first year, the same wild sporting afterwards, only since the divergence between the parent forms in these instances was wider, the range of diversity among the sporting forms was most astonishing. The various characters of the original varieties had entered into innumerable permutations, producing almost every form which could be conceived of. There were varieties with short, closely filled heads resembling the White Hamburgh, and from this extreme was exhibited every gradation of length up to the other extreme of heads six or seven inches long. There were awnless, short awned, half awned, and full awned sorts. Kinds with white chaff, and kinds with red chaff; kinds with thick chaff, and kinds with very thin, almost chartaceous chaff. An inspection of the grain revealed the fullest diversity of size, shape, color and substance. Among so many variations, the several ends I had had in view in crossing were fully realized. The long, loose heads of the Berlin variety had become well set with beautiful grain. I had varieties yielding white kernels of the largest size. I had the hardy, vigorous plants of the Gold Drop, with bright, erect straw, yielding bountifully grain as refined and white as any winter wheat I ever saw. Some fifty varieties from this profusion of forms were under cultivation the past season. To fix the character of these by selection, to test them and reject all but a very few of the highest promise, to increase the stock of such from a gill each to a quantity sufficient for dissemination, all this remains to be done before I can hope to reap my wheat harvest sown four years ago.

An account of another experiment, begun in 1871, will introduce into this discussion of my subject another well ascertained fact in hybridization, that of the sterility, more or less marked, of hybrid productions. Receiving that curious cereal commonly known in Europe as Poland Wheat, which, by reason of its peculiar kernels (they are a third of an inch long, and of a flinty substance), and its monstrous glumes and outer palets (an inch in length), botanists regard as a species distinct from the one usually cultivated in so numerous varieties, *Triticum vulgare*, and have named T. polonicum, a cereal which, on various occasions and under various names, as Wild Goose Wheat, Mountain Rye, etc., has been disseminated in this country for speculative purposes, and, though an inferior grain, sometimes sold for ten dollars per pound. Being impelled by curiosity to see the result of such an experiment, I undertook to hybridize this plant reciprocally with the Berlin variety of wheat. I succeeded in impregnating the Berlin with pollen of the Poland, but failed in the converse operation. I may observe here in passing that it is not an uncommon thing in the hybridization of species, that the pollen of one species may be effective in the pistils of another, while it would be impossible to impregnate its own ovules with pollen of that other. The plants which sprang from this violent union of two forms so diverse, showed satisfactory vigor, but so nearly sterile were they, that I but narrowly succeeded in perpetuating them. They blossomed freely, but set only a very small number of grains, and those were poorly developed. In subsequent generations of this hybrid cereal, the forms that have tended in their shifting variations toward the original types, have become tolerably fertile, but much sterility still rules among them.

Of my experiments in crossing the other cereals I will say little except that the same instability of the young varieties has been observed. By crossing the Excelsior and White Probsteier oats I have put a second kernel in the spikelet of the former, and have increased the weight of the grains of the latter.

I have now exemplified the most important of the laws of hybridization which concern the cross-breeding of cereals, and have shown the facility with which new varieties may be called forth. For the deft fingers of the hybridist has nature reserved the work of modifying and perfecting her creations. In his brain are evolved the full possibilities of her magnificent plan, left open purposely, it may be, to engage his noblest powers. What employment offers to young men deeper fascination in its pursuit, or more golden opportunities for usefulness?

Of the qualifications of the hybridist Mr. Darwin says: "Indomitable patience, the finest powers of discrimination, and sound judgment must be exercised during many years." Of the field before him, Dr. Lindley testifies: "We have but stepped over the borders, and the whole field of hybridizing lies widely spread before us; its boundaries are lost in the horizon, and we shall find them ever receding as we advance."

HOW TO EDUCATE THE LABORER.

BY J. S. SPAULDING, LL. D., OF BARRE.

Man was created to think as well as to labor with his hands.

This is the essential difference between a man and a brute. Instinct is characteristic of the one and thought of the other. Instinct governs the wild animal while taking its prey; thought the Indian while capturing the buffalo. All efficient labor, in fact, must be preceded by thought.

A plan of the work to be done must be made, or it must be clearly seen in the mind of the laborer before he can accomplish the desired change. The nature of the material to be wrought must be considered, the action of the hand must be so directed as to produce the required result in the shortest time, and with the least possible expenditure of muscular energy.

The relative value of laborers does not consist in the amount of their physical strength, but in the quality of the work done.

No one calls that music efficient to stir the finer and holier passions of the human soul which is made up of loud noises and discordant sounds. To effect such a result there must be a harmony of tones, the sounds must be appropriate and produced in the right time and place.

So with the laborer; it is not the boisterous, hasty and noisy man who is the most efficient laborer, but it is the man whose thoughts directs his actions so that they are applied at the right time and place.

It must be evident to the most casual observer that the men of thought are employed not only to plan but even to superintend the erection of the most important works of the nation.

To be able to think and to control his muscular energy to the best advantage, the laborer must be educated.

It will be necessary, at the beginning of this discussion, to notice the difference between learning the boy a trade and educating him, or the difference between a trade and an education.

The ancients divided the arts into two classes: The liberal arts, such as related to music, rhetoric, astronomy, arithmetic, geometry, logic and grammar; and the servile arts, such as were practiced by the slaves. The moderns divide the arts into the fine arts, such as poetry, music, sculpture, etc., and the mechanical or the useful arts, in which the hands are more concerned than the mind. Among those who are engaged in the useful arts, a large number of persons may be found who are entirely ignorant of letters, still they are good mechanics. The slaves of the South were very good artisans, but we find among them very few, if any, artists.

The reason of this is obvious; the artisan requires but little more than the free use of his hands; whereas, to be an artist requires not only a free and skillful use of the hand, but it demands thought and a continued exercise of the intellectual faculties.

The more complicate and difficult the trade or the art, the more mental training is requisite to master the work. Hence, we see why among the English operatives, ignorant as they are, so very few men rise to the surface and become overseers or superintendents in their manufacturing establishments.

In the United States, where nearly every man engaged in the useful arts has had more or less mental training outside of his trade, in the common schools, we find men like Franklin, Lincoln and Wilson, rising, by their own exertions, from the lowest classes of society to the most honored positions in the nation.

To learn a trade is, by no means, a process by which a man may be educated. Here and there a man, while constantly employed in his trade, acquires, by close application to study, mental training and strength of intellect sufficient to manage the affairs of a nation.

Vermont never raised but one cabinet maker who distinguished himself in the Congress of the United States; Tennessee never produced but one tailor who graced the Presidential chair; Massachusetts never adopted but one son who raised himself from the shoemaker's bench to the second office in the gift of the people of the United States. Douglass, Johnson and Wilson were men of iron constitutions, endowed with an intense desire for knowledge, and having, moreover, an inflexible will, they bent all their energies, while plying their respective trades, to the acquisition of knowledge, and thus, during the intervals of work, educated themselves.

It does not by any means follow that every boy can become learned and well disciplined, mentally, because Franklin, Burritt and a few others have arisen to positions of honor and trust.

To all general rules there are exceptions. The men above named fall under this category. The rule, from actual experience and observation of facts, is that hard manual labor and deep thought are inconsistent; no person, unless under intense excitement, can think intently while the body is fatigued.

In accordance with the laws of the human mind, we see why those manual labor schools which, a few years since, were so popular, have nearly all failed; and, also, we see why the position which some honest farmers and mechanics take is untenable. They say the best place to educate the boy is on the farm or in the shop. These are good places to learn a trade, but, if the position taken in this discussion be correct, it follows that a boy cannot, while actively engaged in learning his trade, receive very much mental discipline, or, in other words, cannot be educated. Time, independent of all work, must be taken for this special purpose.

Again, no art, or trade, can be successfully learned until the child has mental discipline or culture to understand, readily, how any handicraft ought to be done. The pupil at school cannot form gracefully the letter "A" or "B" until he sees the form clearly in his mind, and then, with much practice to discipline the muscles of the hand and fingers, he succeeds.

Critics tell us that Milton, in his Paradise Lost, did more to improve landscape gardening in England than any other man. The English gardeners at once attempted to lay out and construct a garden such as Milton had conceived and described the Garden of Eden to be.

The mechanic, in order to construct a good plow, must take into consideration, before he begins his work, the nature and strength of the materials ; he must investigate the laws of draft and the nature of curves, so as to give such shape and proportions to the plow that it will be of easy draft, and, at the same time, that it will turn the soil well.

Unless, then, the child has mental culture enough to form, mentally, the letter to be made—unless the farmer has an ideal garden, already constructed, and unless the mechanic has a correct conception of the plow to be formed—each and all must fail in their attempts, or, at least, construct a mere apology for the thing designed. It must be evident, then, that a certain degree of mental discipline must be acquired before there should be any attempts to learn a trade. It follows, naturally, that the more mental training the boy has, the quicker and more thoroughly will he acquire his trade.

It is said the best song has never been sung, the best poem has never been written, nor the best painting has never yet been put on canvass. The musician, the poet and painter have their ideals which so far surpass the real that an attempt to copy the conceptions of the mind leads to constant improvement in the fine arts.

From this fact, we may arrive at the true source of improvement in the useful arts. The child, at school, should have his ideal letter; the farmer, his ideal farm and mode of culture; the mechanic should have his ideal model, and, when each one of these strives to equal, in the reality, the ideal, we shall find, "improvement will shine in every line."

Common observation shows that the man of thought, though ignorant of the art, is, in reality, the man to whom we must look for improvements in the arts. He may be a recluse, shut up in some lone garret, and there, he, while examining the nature of plants and the laws of their growth, can tell the farmer what improvements can be made to secure the largest crop with the least expenditure of time and labor.

The mathematician, who has devoted long years to the study of abstract sciences, can only demonstrate to the mechanic how to construct a plow or a suspension bridge.

The practical farmer or mechanic is that man who, from his knowledge of the forces of nature, constructs, on mathematical principles, the best plow, the best mowing machine, and explains their utility. The farmer who drives the plow or rides and directs the mowing machine is only carrying out the intention of the inventor.

Ericson, when studying the higher mathematics in Sweden, was no less a practical engineer than when, superintending the construction of the Monitor, in New York city, he, though ignorant of the art of ship-building, devised, on scientific principles, a single gun-boat that not only saved his adopted country from the power of the slaveholder, but has remodeled all the navies of the world.

Commodore Worden, in taking the command of the Monitor, only carried out the intention of Ericson.

I am aware that I am combining in what I call practical labor, more or less theory; this is just what I intended.

We speak of a practicing physician or a practical teacher—do we understand, by these terms, that these men have no knowledge of the theory of these professions, and the nature of the subjects on which they practice? Do we not entrust the safety of our lives and the education of our children to those who understandingly base their practice on a well-known theory?

We believe this will be admitted as sound doctrine and should be adopted by practical men.

This leads me to inquire how the laborer should be educated, or what branches of study should those who are designing to engage in the useful arts pursue?

We have seen that, generally, an education cannot be acquired while actively engaged in learning a trade or laboring on a farm.

We have also seen that the man of thought is really the great benefactor of the useful arts. The first thing, then, for the farmer or artisan to secure would be a thorough mental training. It will be admitted that mind, like matter, is governed by certain fixed laws. To accomplish, in the shortest time, a certain mental effect, the antecedents to such a result must be complied with. The process of growth and progress in the mind of the boy, who learns an art is the same, in every respect, as in the lad who intends to enter the profession of law, medicine or theology ; consequently, to secure a thorough mental culture for the artisan and the farmer, the same course of study is necessary as for the lawyer, the physician or the clergyman.

In discussing this part of the subject, we must be guided by the opinions of those men who have carefully studied the nature of the human mind and the means by which its powers are developed and disciplined.

I am well aware that there are two opinions advanced as to how the human mind can be trained. It is the part of wise men to examine carefully a subject so intimately connected with the success and welfare of the laboring classes in our country.

Senators in Congress, after they have come in contact with a Webster or a Sumner, have regretted the mistake they made, in youth, by listening to the advice of those who thought a liberal course of instruction was of no practical importance.

Lawyers and physicians, after years of practice, have acknowledged the error they committed, in early life, by thinking Latin and Greek to be dead languages, and of no practical use. Many a clerygman has left his pulpit for the academy and college.

Had the mechanics and artisans of the country had a thorough mental training in the study of the languages and political economy, they would not now resort to "strikes" to redress any real or supposed wrong done them.

The farmers, feeling their need of more information on the theory of agriculture, demand of the State appropriations of funds to establish a Board of Agriculture, and to publish its doings.

Colleges, for the special benefit of the farmer, have been founded, in which agriculture, the mechanic arts and the natural sciences are to be taught; but the advocates of these schools, having learned from observation and experience that a classical course of study is essential for a thorough mental training, have practically ignored their work.

From the East to the West and from the North to the South, associations for the improvement and elevation of the laboring classes have been formed. All this unrest and tossing to and fro on the part of the laborers in our country indicate a lack of thorough mental culture.

A well disciplined mind and a good store of general information constitute the only guarantee of success in any vocation of life, and, in our opinion, would harmonize all the difficulty between the capitalist and the laborer, and also between the producer and the consumer.

This tacit and openly acknowledged demand on the part of professional men and laborers for a more complete mental culture, is a proof that the discipline formerly acquired by men who hastily entered into practical business is not, in the end, desirable.

Knowledge, however desirable, is not the object sought by the real instructor. There is a vast difference between a pile of the various materials of which a house is built and the house itself. The one is a shapeless mass of confused matter, entirely useless as a tenement for human beings, the other a thing of beauty, fitted for the protection and comfort of man.

We are all acquainted with facts; these, like the pile of raw materials are very useful, and constitute, in the mind of the great mass of the people, what they term practical knowledge, but, as facts, they are just as useless as the unwrought material in the forest or in the bowels of the earth.

The mind must acquire the power to select, classify and bring each fact into its true relation to the other facts, and see that it accepts the right position in reference to the whole subject to which the attention may be given.

This habit of mind acquired and carried to a certain extent constitutes the foundation on which all trades or professions must be erected, and without it there must, necessarily, be much unrest and dissatisfation in one's vocation.

The object of mental training is to call out the man, *not* to make him a farmer or a carpenter, *not* to make him a physician or a clergyman, *not* to make him a lawyer or an engineer—but to give him a discipline, the power to take up any subject that may come within the range of his thought, to separate this into its parts, to examine carefully each of these parts by itself, to notice the difference or similarity between them and to mark, accurately, the relations they sustain to each other and to the whole.

The fundamental principle in education is not to give the man a special training to pursue some particular calling in life, but to furnish him with a general culture that will prepare him for any vocation, and to give him the ability to take up any business that may present itself—to give him the power to investigate and understand its principles, and so to comphehend its details that, from it, he may secure to himself the greatest good in the shortest time. Hence we see why Henry Wilson learned the trade of making shoes in one-half the time required by men in general. Here we see why young men of college education become, in a short time, efficient in their professions.

Such discipline gives a man a broad culture, enlarges and liberalizes his views of persons and things, and yields him, in his declining years, a rich harvest of healthful thoughts and pleasurable emotions.

Is such a discipline of mind within the reach of all our youth?

I would say to nearly all. The State makes provision for the primary education of all. In our schools the foundation for a broad mental culture may be laid, and, with the ordinary degree of enthusiasm found in the American character, the means and opportunity can be obtained for extending the work already begun. To accomplish so desirable an object, in the shortest time, the course of study that will bring into active exercise, at the same time, the largest number of the intellectual faculties, is deemed, by educators, the most effective.

It is admitted by all that the sciences will discipline the mind. But it is found, from actual experience, that each science is adapted to train only some particular faculty. Hence, to give a man such mental culture as is necessary for success in business, a longer time is required in a scientific than in the classical school.

The mathematics, in both courses, must be carried to the same extent; nearly all the "ologies" in the scientific course must be studied at a very great disadvantage, because the language of science is, essentially, classical, and in the Latin and Greek languages we find every scientific term, from arithmetic to psychology, accurately defined.

No one of the sciences, according to the testimony of the friends of scientific learning, can be found among all the "ologies" in the English language that can call into active exercise, at the same time, so many powers of the human mind as the first oration against Catiline or the first book of the Iliad.

If, then, we take into consideration the nature of the discipline, the work done, and the expenditure in time and money, we may fairly come to the conclusion that, of all the means for the mental training of the laboring classes of our country, the classical is the most efficient and economical.

Let, then, the laborers avail themselves of a culture of this kind, and we shall find more enterprising farmers, and more successful and skillful mechanics. Farming will be made more attractive, the mechanic arts will be more pleasing, and the children of the laborers will rejoice to follow in the footsteps of their fathers.

NATURAL LAWS AND THEIR RELATIONS TO THE FARMER.

BY HON. F. D. DOUGLAS, OF WHITING.

The most superficial observer of the phenomena of nature cannot fail to recognize the evidence of intelligent design which pervades all its works. Order reigns supreme. No chance event, however trifling, unpreceded by its appropriate cause, ever disturbs the harmony of its operations. The relation between cause and effect is unvarying, and may be computed with mathematical precision when the first is fully comprehended. A continuous chain of relationship of causes and consequences extends throughout all nature, uniting her works into one harmonious whole.

> "From Nature's chain, whatever link you strike,
> Tenth or ten-thousandth, breaks the chain alike."

UNIVERSAL ORDER THE RESULT OF UNIVERSAL LAW.

Universal order only results from the operation of universal law. The most minute natural phenomenon is just as completely the result of its operations as the revolution of the planets in their orbits. The same law which impels a drop of water to assume a globular form, also moulded the earth into the same form at the dawn of creation. The same laws which governed the growth of the plant life in primeval ages, which developed the giant forests whose remains are now found in our coal formations, are now in force, controlling the growth of our forests and crops. Those laws which governed the growth of extinct races of mam moth animal life, whose fossil remains are the only evidence left us of their former existence, were the same by which the farmer must now be guided in the development of his domestic animals.

NATURAL LAW ALL PERVADING.

This code is all pervading. Its influence reaches not only all material things, but it also influences through these all industrial occupation. It extends its controlling power over our lives and health, and gives us no alternative but obedience, or sickness and its accompanying dangers of premature death.

THEIR AUTHOR.

We should be impressed with the fact that these are the laws of God, and that He holds us alike responsible for the observance of those which apply to ourselves, as for the observance of his moral laws. They are so intimately related that the violation of the former often involves the direct and flagrant violation of the latter.

The knowledge and observance of natural and moral law constitute the difference between an enlightened and barbarous state, the elevating influence of the former being scarcely less than that of the latter, while all material improvement is dependent upon our knowledge of those laws which govern material things.

THEIR PERSONAL APPLICATION.

If I violate that part of this great code by which physical health is governed I expose my life, and I must take the consequences and suffer for my sin against the law. And what folly for us of this enlightened age to charge the effects of such sin upon our Creator.

POPULAR ERRORS.

If I go from my warm dwelling into the open air in midwinter and stand, with my feet half clad, upon the snow while talking with a friend, I violate natural laws; and if the result is lung fever, or pulmonary consumption, and consequent death, I alone am responsible for the result. Yet mourning friends would doubtless talk of the event as one of the mysterious providences of God, and never think of it as the result of violated law, and go on themselves sinning as before.

If I allow decayed vegetables, garbage and filth to accumulate in my cellar, foul sewerage to affect the water in my well or poison the air of my dwelling, these violations of natural law will be very liable to culminate in some fearful scourge like dysentery, typhoid fever or kindred evils, and if members of my household are thus removed by death, purely in consequence of my culpable ignorance or neglect, what a commentary upon our civilization to hear from the sacred desk the statement that this is the result of God's inscrutable providence, that He fixes the limit of our days, and that the occurrence was only the result of the fact that the victims of my sin had reached the limit assigned them; thus charging the calamity upon God, and not improving the lesson by even a suggestion that it might have been the result of a violation of His laws.

What a commentary upon our religion to hear our spiritual teachers endeavor to impress the lesson upon their hearers, by charging them to be more faithful in the discharge of religious duties, to be more punctual in their observance of the ordinances of the church, as if the performance of these duties alone would avert such evils.

INDIVIDUAL DUTY.

That prayer for the health of ourselves and our households is a sin if not attended by appropriate works of purification and the necessary observance of hygienic laws. The lesson of such a scourge as the one supposed is lost upon us if it does not teach us to properly care for our cellars, sewers and wells, and to study the laws which govern our own organisms, and be guided by their precepts in caring for ourselves and our households.

BAD LUCK.

The farmer, too, who talks of bad luck when his stock, from like neglect, fail to thrive, or die of disease contracted in consequence of his own culpable ignorance, in this respect is little better than a heathen. There is an appropriate law which governs every phenomenon which the farmer observes in connection with his calling, and he, as well as the most profound naturalist, should at least learn the effects of the operation of those laws which immediately apply to himself and his business. Sequence follows cause with mathematical precision, in the calling of the farmer, as well as in the laboratory of the chemist.

WANT OF THOUGHTFUL, OBSERVANT HABITS.

The same natural changes are as constantly occurring before the eyes of the most stupid farmer as the most learned naturalist. The one, in his stolid apathy, heeds them not, while the other is an interested observer, and intelligently watches for their occurrence. Every farmer with right habits of thought and observation may be a naturalist, and while acquiring a fund of interesting knowledge, also add materially to his prospects of success. He should be as interested an observer of natural laws as is the astronomer, the chemist, &c. They usually apply themselves to the study of pure science; the farmer should to that of applied science. The pursuit of one is no more noble in itself than the other; each present their appropriate problems for solution, and those, too, which the best intellects have not yet been able to solve. The intelligent pursuit of agriculture implies the constant study of the great book of nature, which an Infinite hand has spread out before us, on every page of which we behold the impress of its Author.

WHAT WE CANNOT UNDERSTAND.

We cannot understand many of the phenomena which we observe in the pursuit of our calling. It is not for us to comprehend that mysterious power which directs the growth of animal and vegetable life, which directs the giant oak and the tiny flower to assume their respective sizes and forms, when nurtured by the same soil. We cannot comprehend that power which gives to the oak its characteristics, or arranges with more than painter's skill that beauty of design, that variety of tints and perfection of coloring which every flower garden presents; that power which causes the different plants to cull out from the same soil, and combine in their respective forms, those elements which constitute the deadly vegetable poison; the luscious, the sour or the bitter fruit; the delicious sweets, the aromatic spices, or those fibrous vegetable substances from which we weave so many of our valuable textile fabrics.

We cannot tell why the delicate fibrous rootlets of the tree penetrate the soil, and gather up the moisture which holds in solution some of the constituents of its own future composition, and propels it in the form of sap through the woody labyrinths of its roots, trunk, and branches to its leaves, where, by their peculiar mechanism, it is assimilated and prepared to perform its office. We cannot comprehend the cause of its return to assume the place assigned it in the wood, the bark, the flower, the fruit or the seed, just where it is wanted to perfect the full development of the tree, producing in each variety of trees and shrubs their own peculiar form of development, each re-producing its kind in infinite succession. We can only say that the life giving principle which produces these strange phenomena springs from the First Great Cause, and cannot be comprehended by finite minds.

EVIDENCE OF DESIGN.

The farmer is surrounded with these evidences of design, and by them he is brought into direct and pleasing contact with that power which, by established laws, not only directs these minute affairs of nature, but also holds and guides the planets in their courses and peoples the immensity of space with its countless systems of worlds.

WHAT WE CAN UNDERSTAND.

Though it is not for us to comprehend the original source of these laws of nature, we can observe their operation and determine their effects. It is ours to understand and apply such of them as may contribute to our success ; to trace the relation between causes and effects, which these laws have made inevitable ; to so arrange and control those causes and conditions which we can influence that the desired effects may follow.

MECHANICS.

It is ours to understand those mechanical laws which apply to the construction and use of those appliances which an advanced and progressive agriculture demands, that wemay judge correctly of the principles upon which our farm machinery is constructed, that there may be no unnecessary waste of power, and that we may discover the defects, if any, in its proportions and mechanism.

METEOROLOGY.

It is practicable for us to understand those meteorological laws which prevail in the atmosphere, that we, aided by those helps which science has furnished us, may predict the approach of storms, or foretell, with a good degree of certainty, the future prevalence of fair weather in harvest time.

BOTANY.

We should know something of the structure of our plants, the functions of their different parts, their classification, and the terms employed in their descriptions. Learn to detect imperfection, and to select the most perfect seeds, and such varieties of plants as are best adapted to a given locality, to the supply of our own wants and the wants of the market. Our seeds must possess perfectly developed germs, be selected from those plants which, by a long course of good culture, have attained the most perfect and symmetrical development, and have assumed a fixed character. Plants, like animals, may be improved, or by bad management may become dwarfed and sickly. The vigor, the life principle of which I have spoken, which the germs of all healthy seeds possess, may be so reduced in its vitality by continued bad culture that the rootlets of the plant will not penetrate the best soils sufficiently to take up the nutriment necessary to produce a large crop. A weak and sickly growth and light yield are not always attributable to the soil which produce them, or to the seasons, but may often be attributed to previous bad culture. Of such crops we say that the seed has run out, and like produces its like again. Good culture is but the observance and application of natural laws, and bad culture implies their violation.

AGRICULTURAL CHEMISTRY.

It is for us to learn the constituents of our soils, and also of those plants which we would grow upon the different varieties. If all the elements which enter into the composition of our plants do not exist in the soil or atmosphere, it is useless to expect to mature a crop. That field which once produced thirty or forty bushels of wheat per acre, and now produces but ten, when, to the casual observer, all the conditions which ensure a good crop seem equally favorable, when carefully analyzed will be found to have lost some of its essential elements, taken from it, ordinarily, by previous cropping. It may prove that but one element is wanting, and that one which may be easily and cheaply supplied, while all the others may be present in abundance. It is for us to learn the cause of failure, whatever it may be, and apply the cheapest and most effective remedy.

This implies, also, a thorough knowledge of the constituents of the manures which we apply, that we may not waste our money by the application of such elements as the soil already contains in sufficient quantities, or of those spurious fertilizers which do not possess the virtues claimed for them by their venders. Nature performs no miracles. She can not produce a perfect work without proper materials with which to build, any more than the mechanic or artisan; but with them and favoring circumstances, she performs wonders.

EXHAUSTION OF SOILS.

We should know what crops are least, and what most exhausting to our soils, that we may not rob nature of her material with which to build, and that we may correctly compute the profits derived from the production of each. The cost of seed and labor, and the amount of our receipts for the crop, are not the only items which make up the account by which we determine our profits. We may receive twice the income from a field of tobacco that we do from the same field when in clover, and after allowing for the difference in the cost of seed and labor, and also for the exhaustion of plant food from our soil, find the clover to be much the most profitable crop. The tobacco may have robbed our soil of constituents much more valuable for the growth of future crops than the value of the extra amount received for the crop itself.

We must know and appreciate the fact that the farmer's wealth is based upon the plant food deposited in his soil. If we ignorantly or purposely draw upon that deposit until it is exhausted, we, as farmers, must become bankrupt. Natural laws, indeed, aid us in the restoration, but by too slow a process to answer our purpose. We must, like the banker, husband our deposits, and learn to make the most of them; to raise such varieties of crops as will bring the best pecuniary returns after deducting the cost of seed and labor, and also replacing the draft upon our deposits.

PREPARATION OF SOILS.

It is ours to understand what mechanical condition of our soils will promote the most rapid growth, and best protect our crops from extremes of both drought and moisture, and how to prepare them in such a manner that the rootlets of our plants may readily penetrate them in search of food and moisture. It is practicable to so prepare them that they will support a luxuriant growth of vegetation, when other fields present by drought a parched and withered appearance, or, from excessive moisture, a dwarfed and sickly herbage; to provide against any unnecessary delay in sowing our seeds in spring, and thereby cause so early maturity as not to endanger our crops by frost.

LANDSCAPE GARDENING.

Our dwellings, whether expensive and elegant, or cheap and simple in their architecture, should be surrounded by grounds laid out in the neatest and most attractive manner. A cultivated taste may make the home of the peasant more attractive than that of his more wealthy neighbor, who does not possess it.

A convenient cottage farm house, surrounded by tastefully arranged grounds, and only adorned with those simple rural attractions which nature cheaply provides for all classes who have a place to cultivate them, may be a better home in which to enjoy life, than the most artistically wrought palace without such surroundings.

MANUFACTURES.

A knowledge of natural laws is necessary also in conducting the manufactures of the farm. In the dairy department, especially, there is much to be learned and many problems to be wrought out. The most skillful have not attained that systematic perfection in all its details that has been acquired in most other departments of industry.

SELECTION OF STOCK.

In the possession and care of domestic animals we have need of a wide range of knowledge of these laws. Much depends upon their proper selection and adaptation to the purposes for which they are kept. The successful farmer must have a clear conception of the objects to be attained, and of the peculiar natural excellencies which best adapt each animal to its purpose.

BREEDING.

In the breeding of stock this critical discernment of nat urally essential points is indispensable. Not only should we have a clear perception in detail of the peculiar combination of excellencies which best adapt the animal to a given purpose, that we may form a correct ideal model of perfection, but also that intuitive faculty, that gift for recognition and combination of excellencies, which enables the skillful breeder to reproduce the ideal model in the living animal. Man's power over his domestic animals, in shaping their forms and determining many of their characteristics, when aided by a thorough knowledge of natural laws, is almost creative. By this power, combined with the necessary food and care, the beautiful Shorthorn, which sprang from common stock, has attained the characteristically symmetrical proportions which we observe in the best bred specimens of that race, and in him we behold the fac-simile of the ideal model which served as a guide to his breeders.

The well bred race horse, and the muscular draft horse are other examples of this intelligent design. Individual excellencies may come by chance, but the production of a full and perfect development which varies in any considerable degree from the original type, and a fixed habit of reproduction of it in the newly created species, is the work only of intelligent, persistent effort.

FOOD FOR STOCK.

The adaptation of food to the condition and necessities of our various animals, and its preparation and supply in the best manner and amount to produce the most perfect thrift with the least waste of material, is another interesting field for study and observation. An over supply of nutritious food not only results in a direct waste of material, but endangers the health of the digestive organs of the animal. All the necessary constituents may also be present, and in just the right amount, and yet, as in over ripe grass, be so locked up and unavailable as to defy the powers of the digestive organs to digest and assimilate them.

ZOOLOGY AND VETERINARY SCIENCE.

We should know something of the anatomy of our domestic animals, and of the functions of their organism. We should study those hygienic laws, by the observance of which, only, we can maintain in them the most perfect health and vigor of constitution, or restore them to health when diseased. We should consult their natural history and habits, in determining the amount of exercise which we should give them, and the kind and degree of protection which they require. The horse, the cow, the sheep, the swine, in short, every variety of farm stock needs its peculiar care.

ENTOMOLOGY AND ORNITHOLOGY.

The farmer has many natural enemies to contend with, as well as friends to aid him. His orchard, garden, meadows, his grain and potato fields swarm with insect life, many of which prey upon his crops and often ruin his hopes of success. He has also numberless forms of parasitic life to contend with. He should study the nature and habits of all these, and learn how he can most effectually avoid or destroy them. In the feathered tribes he finds industrious workers which aid him in their destruction. He should observe the habits of these, also, that he may learn to appreciate and protect them.

MICROSCOPY.

There is also a wide field for study found in those microscopic forms of animal and vegetable life, which exist in countless myriads around us, and which affect, more or less seriously, the interests of the farmer. That diseased and unwholesome milk may have been rendered thus by the microscopic contents of the water which the cow drank from the stagnant pool, and which have multiplied in her and her product, to an almost inconceivable extent, and have baffled all attempts to convert her milk into good butter or cheese.

Countless microscopic spores, and germs of putrefaction in various forms, infest the air, causing mold, mildew, blight and vegetable rust to fasten upon the farmer's crops and stores. Even in the yeast used by the housewife, there first springs up this kind of vegetable life, which is soon succeeded by a swarm of animal life, which, in turn, decays, and converts the whole into a putrid mass, emitting that unwholesome odor peculiar to stale yeast, especially to that composed largely of milk, and, of course, rendering it unfit for use. The pork he fattens may contain the germs of parasitical disease, which he should learn to detect and destroy. The tape worm, trichina, etc., are examples of this. A knowledge of this world of minute existences is properly embraced in the scope of an agricultural education.

These are some of the most obvious subjects for thought and observation, and challenge the investigation of the progressive farmer. He who fully comprehends the nature and importance of the numberless questions to be settled in perfecting the details of a complete system of agriculture, will not fail to discover subjects enough for thought in this department of industry. What science presents so wide a field for practical improvement, or so many subjects of interest to the curious observer of natural phenomena, as this?

Yet a scientific knowledge of agriculture will not alone insure success in farming. Only a diligent application of its principles, under the supervision of sound judgment, and a good degree of practical common sense, will do this. The indolent man should never attempt to gain a living by agriculture, drones cannot thrive by this occupation; and the mere theorist, he who only imbibes ideas, without an intelligent knowledge of their practical value and application, will not succeed in this calling.

But, says an objector, of what use is all this learning to the farmer? Our fathers got along without it, and so have we thus far. True; but our fathers found here a virgin soil, rich in all the elements of plant life. This natural deposit has been greatly reduced, and comparative sterility has taken the place of superior fertility. This has been brought about by the agricultural vandalism of the past three generations. Farms, where once large crops of wheat, corn, and other grains could be raised upon any of the arable land, now, if raised at all, only on comparatively small areas, and by the application of patent fertilizers, or by placing the entire farm under contribution to supply the necessary manure.

If this process of depletion is continued, much of the land of our State must be abandoned for agricultural purposes, and, indeed, much that was once fertile has already been left to the growth of bushes and briers, and thousands of acres more scarcely pay for fencing, by the scanty pasturage which they afford.

We hear complaints, too, that the farmer's lot is a hard, slavish one, and that his business does not pay. From what class of farmers does this complaint come? From those whose wheat fields yield thirty bushels per acre, or those whose average yield is only ten? Whose corn fields yield sixty bushels per acre, or those who get but half that yield? Whose sheep produce eight pounds of wool per head, while they sell their increase at high prices because of their superiority of blood, or from those who annually receive three or four pounds, and sell their surplus stock at pelting prices? Those whose horses are so bred that they will command the highest market prices, or those who breed scrub stock? Those who have increased the productive capacity of their cows to three hundred pounds of butter per head yearly, or its equivalent, or the average farmer, whose cows produce less than half that amount? Who complains that farming is a slavish and menial calling? Only those who conduct the business in a stupid and thoughtless manner.

But, says another, when have we time to learn all this? I reply, when can the lawyer, the clergyman, and the doctor find time to master their professions? They begin in youth, and make their business their study, and those who are most successful bend all their energies to the acquirements of the science which they profess to teach or practice. The farmer cannot reasonably hope to master his profession in any other manner; he must study, think and investigate for himself. If he has not the means to enable him to devote three or four years exclusively to study, he can, at least, acquire habits of observation and mental application, which will make his farm a school for his own education, and that of his sons, also. Such a habit, with convenient access to a good library, in the reading of which he can spend his winter evenings, is far better for a practical farmer than the pursuit of a college course, even in our so-called Agricultural College, without such a habit.

The farm is the only place where a farmer can obtain a practical agricultural education. It is to him what the laboratory is to the chemist—the place to acquire, or at least to perfect, his agricultural education. The time in which to acquire it is as long as that which he spends upon the farm, even if it be three score and ten years. If he is a good scholar, and ambitious, he will master his profession; but if stupid or indolent, he will find little to learn in connection with it.

Our fathers accepted a low position in society, and taught their sons to look upon the pursuit of the learned professions as more elevated and honorable than their own, because more intellectual. They regarded professional men as their mental superiors, and accorded to them the right to do the thinking and speaking for the public, if not for themselves. The time has been when a lawyer had more influence in shaping public opinion, upon all important questions, than a score of average farmers; and that is not wholly past. Intellectual superiority should be recognized wherever we find it, and it will be, whether we would have it so or not, and, I am sorry to say, even if unconnected with moral integrity. The question is not one of dollars and cents alone, but of positions of honor and of worth. Shall we plod on in the old way and surrender these, or shall we fit ourselves to rise to the possession of them ?

The time is not far distant when, like our brethren in England and Germany, we shall be obliged to bestow more thought upon our business, or sink into hopeless poverty, and oblige our posterity to emigrate to some other naturally fertile field, to there repeat the vandalism of their fathers. The rich prairies of the West are now being thus depleted by those who have emigrated from New England. When these new fields are exhausted and our descendants compelled to make farming a mental, as well as a physical pursuit, then will agriculture, and the agriculturist, be elevated to their true positions.

The model farmer possesses those active habits, that practical turn of mind, that intuitive forecast of the future state of the markets, that general intelligence, and strict integrity, which, combined with a scientific knowledge of his calling, will always insure success. You will observe that this implies a great deal, nothing less than that the farmer should be a well developed man. And what calling tends more certainly and directly to a full, manly development than that of the agriculturist, when properly pursued ?

We farmers may be low and groveling in our habits, rough and boorish in our manners, thoughtless and weak, intellectually narrow, superstitious, and bigoted in our views, dwarfed and deformed in our physical development, we may drag out a miserable, slavish existence; but, if so, it will not be the fault of our occupation. The members of the so-called learned professions may do this. It is for us to determine whether it shall be pursued in a manner calculated to elevate ourselves or not. Whether it shall contribute to a healthy physical development, asound mental growth, and to those noble, moral qualities, which characterize a well developed manhood. Let us remember that the most important crop to be matured is the farmer and his household, and let our business be so conducted that it will contribute to this great end. If we study those natural laws by which we develop our business, we must, inevitably, be developed ourselves, and thereby rise to a higher civilization and a nobler life.

In conclusion, let me say that the true index to our development will be found in our works. Not, indeed, in the amount of money we shall have succeeded in hoarding, but in the evidences of culture and thrift which will appear around us; in our homes and their surroundings, and in the improvement which we shall make upon our farms, in our gardens, orchards, and meadows; in improved crops, stock, and implements of husbandry. A photograph of these would usually indicate the habits, intelligence, and thrift of their possessor. It does not appear more obviously in the expensive surroundings of the costly palace than the simple adornments of the humble cottage. If right habits of thought and application exist, they will, like all true Christian virtues, show themselves in the works which they will inspire:

SANITARY REFORM.

BY DR. L S. WISWALL, OF CABOT.

I am well aware how often we hear of the pure mountain air we breathe. How pure the water with which we are supplied. How *our* people are not crowded into cities, but rather have all the surroundings of nearly perfect sanitary conditions.

If the above is a quite correct picture of our condition, a paper upon this subject will hardly be of interest sufficient to merit your attention, and we can be better employed than in its reading.

But one terrible fact, that nearly one-half of all the children born die before the expiration of one year, may well cause us to pause in the course of our self-gratulations.

We, at the distance of four thousand years, read with melancholy interest of that Egyptian king, of infamous memory, who killed all of the Hebrew male children; also of that other king, who made himself equally infamous, in a like manner, by destroying one-half of the Jewish children of Bethlehem. And here let us remember that, had they lived at this time, they would have found one-half of this slaughter of the innocents done without *their aid.*

There can be no good reason for this frightful mortality. It must be apparent to every one that there is (to use a homely phrase,) a pretty large screw loose somewhere. That there exists a powerful and terrible element that has, until recently, escaped observation, is but too evident.

History is replete with accounts of the terrible visitations of disease, that have decimated the human race, at no great intervals of time. We have all read of that Abyssinian captain, whose whole army of nearly two hundred thousand men was destroyed in a single night by the plague.

Says Josephus: "It is barely five hundred years since the whole world was devastated by the black death, destroying one-third of all mankind."

The ravages of the plague, cholera and yellow fever are too well known to need further mention here, and, as they are not of a type that is likely to prevail in our climate, we may dismiss them with the single remark, that they are infectious or contagious, and the natural outgrowth of bad sanitary conditions.

Although we may have no reason to fear the invasion of either of the above named, we are far from being safe from infectious diseases. We have all the contagious diseases. Then we have all of those now claimed to be infectious, which includes such as pneumonia and consumption, not to say anything of those terrible ones—canker-rash and diphtheria—and all the different forms of fever. These are claimed (and with an array of proof hard to be gainsaid,) to be *all infectious*, *all contagious* and *all* preventable.

It is likely that all present have seen, within the past two or three years, the term, "The germ theory of disease." In some this may have awakened no feelings of curiosity, even; others may have been content with the belief that all our ills are in accordance with divine decree, and that it is an inscrutable Providence that takes our loved ones from us. And, as is natural, many will be loth to believe that any neglect on their part has been the cause of the fatal illness of some dear child. And thus, between indifference and indisposition to look for causes, this subject has not awakened an interest at all commensurate with its importance.

That most diseases depend upon a specific cause, perhaps no one will deny; and it has been customary to speak of this, often, as a prevailing influence—a something in the air, and thus, like many another, they "builded better than they knew."

It is this *identical something* that we are *looking for* both in the air and in water.

The researches of a great number of observers, aided by the microscope, possess for us a profound importance. It is certain that the microscope has shown us the identical exciting cause of very many diseases. Small pox is a notable example, as well as some of the fevers. In the above, the blood and tissues are the seat of certain growths, which are always present, either in one or the other.

I may be pardoned for saying what you all, perhaps, know, that the microscope reveals to us a world of its own, filled with life, both animal and vegetable, as various as the one we see.

It is necessary to know the names of but few of these little growths, and just what are animal and what are vegetable is, perhaps, not very well known, and, for our purpose, it does not matter.

Some of the minute organisms are called bacteria, and, for convenience, we will use that term in speaking of them. We will remember that some of these are so small that it takes thousands, or even millions, to form a mass large enough to be seen by the unassisted eye; and, that we may not lose sight of the fact that numbers can make up for size, I will give a few instances illustrating the importance of these minute and seemingly insignificant things.

If we examine the underside of the leaves of a barberry bush, next summer, we may be able to see little yellowish mould or what looks like that. Now if a few grains of this happen to be conveyed to a field of wheat, the straw, in a few hours, becomes covered with what the farmer calls rust, and all hopes of a harvest are destroyed by this something, so small as to need magnifying hundreds of times to become visible.

Again, we read of the destruction of the grape vines, and here we find that our little enemies have been at work.

Yet, again, the silk worm sickens and dies, and again the glass shows us the cause.

The story comes to us that a whole nation is in danger of starvation by reason of the failure of the potato crop; and, again, we have but a further illustration of the not only interesting, but terrible importance of these microscopic growths.

But we will leave the vegetable world, and give a few instances from the animal.

Among the brute creation, we find these same "germs" present in many of the most fatal diseases, like glanders in the horse, murrain in the ox, and foot disease in the sheep; and, no doubt, further researches will show their presence in all epidemic or infectious diseases of the brute creation.

One more illustration, and, to many present, the subject will awaken sad memories. But, as the disease is so well known, and its cause has been so carefully studied and described by patient observers, that I do not feel like omitting to mention it.

In diphtheria, the false membrane so characteristic of this disease has been shown by Vertet and others to be composed almost entirely of bacteria. These not only make up the membrane, but pervade the whole system, and make up, by their presence, the large swelling of the parts near the favorite point of attack, and either causing death by obstructing the circulation or by causing paralysis of the heart.

Again, we see these, or kindred organisms, present in dysentery, cholera infantum, and, in fine, it would be difficult to mention a single infectious disease in which the microscope does not surprise us by its revelations; and I have no doubt but that, in the near future, the cause of all infectious, and *all epidemic disease*, will be found and ackowledged by all observers to be "specific germs"—*like* producing *like*.

And in view of the fact that we have but little, if anything, to hope from treatment by any known remedies, we may be pardoned in wishing the day not distant, when old theories shall be made to stand aside for those consistent with known facts.

By way of illustration, I will say that, when we fully understand that no case of disease ever occurs without the taking into the system of the "germ," then, and only then, can we hope for anything like sanitary reform.

Of course, in a paper like this, any attempt to do more than mention a few of the innumerable things connected with this subject will be impossible, and much will be left unsaid that should be said. But one thing occurs to me now that may need explanation, and that is, how these small organisms (animal or vegetable, as the case may be,) can become so numerous as to cause such effects in so short a time?

This, I think, will be easily understood when we consider their manner of multiplying. This is by what is called scission—that is, one divides and becomes two; two, four, four, eight, and so on. And, when the nutriment upon which they feed is abundant, these changes are almost instantaneous, and it will not tax our imagination to understand how it is that vegetables and animals are in many cases literally starved to death.

In writing the above, I have not lost sight of the fact that certain conditions are necessary to the existence of these fungoid growths. It will not be necessary to enter into a labored argument to show that bad surroundings are dangerous to life, that we cannot expect good health while breathing foul air or drinking impure water. Yet that many do this for a long time, is a strong point in support of the "germ theory." Hence the deduction that the cause of disease is made up of several factors. And to recapitulate:

First—We will suppose a person somewhat weakened by overwork or some other cause. Then, to have a case that shall present as few chances of recovery as possible, let the air be loaded with the emanations of decaying animal and vegetable matter; then, let the person take into the system the "germ" of some disease, and (my word for it,) we shall witness a set of phenomena that should lead us to inquire into the causes, and, further, the means of prevention.

And just here it occurs to me to say that many of our most dangerous diseases, like pneumonia, diphtheria and scarlet fever, are not supposed by some to be infectious. The reason for this may be found in the fact that, of all diseases, these are the most easily communicated. And it is no exaggeration to say that there is no proof that a case of typhoid fever or any other acute disease ever originates "de novo."

How these germs are carried from one place to another may be a proper subject of inquiry.

If we place an open dish, containing water that has been distilled, in a warm situation, we shall see it, in a short time, become cloudy, and the microscope will reveal the existence of innumerable living organisms.

Now these germs must have come from the air; and, further, such observers as Tyndall and others tell us that they are unable to find any pure air except in the air cells of the lungs.

Hence, the fact is apparent that these minute organisms are always present in the air, in a dormant condition—not dead, but ready to spring into life upon finding a proper situation.

One fact more. I will not fail to speak of it, even at the risk of repetition.

It seems that many of these "germs," like so large a proportion of all insect life, undergo certain transformations.

Thus, the germs of small pox and scarlet fever are perfected in the sick person, and ready to infect the well person without further change; but the "germs" of the cholera and typhoid fever need undergo some change before they become infectious.

I have not attempted to draw a fanciful picture, and I think I have said no more than the researches of living and live observers will justify.

It is not likely that any one present will claim to be ignorant of what constitute good sanitary conditions. And, if there is any lack of knowledge, it will be in the direction of not fully appreciating the deleterious effects of the foul emanations from cess-pools, damp cellars and badly constructed drains. In fine, we need to fear that every bad odor may be freighted with the seeds of some terribly fatal disease.

When the Doctor closed, Prof. Seely asked him if the germ in typhoid fever could be detected by the physicians?

Dr. Wiswall—It is not well enough known. The germ in diphtheria is the smallest of any known growth, and that can hardly be detected with the microscope. In relapses the blood is filled with these germs, but it has been found that you cannot produce a case of typhoid fever on an animal by innoculation.

Prof. Seely—Are the conditions of the disease known, and its preventives ?

Dr. Wiswall—Yes, the discharges should be treated with disinfectants, and the bedding kept clean.

Mr. D. M. Foster, of Calais—How shall we drain our cellars ?

Dr. Wiswall—Drain from the outside. But you all know how to do it. The rule is never to have a bad smell.

Mr. A. O. Cummings, of Montpelier—Would a spring of pure water in the cellar do harm ?

Dr. Wiswall—I should not want it there, on account of the water.

J. M. Fisher, of Cabot—Are cisterns in cellars bad things ?

Dr. Wiswall—Should hate to build one.

Mr. Dwinell—Does water running through lead pipe become poison ?

Dr. Wiswall—It depends on the character of the water. Soft water that would corrode the pipe would be, but hard water, containing carbonate of lime, would form a coating over the lead, and not be affected by it. There are more cases of typhoid fever from drinking impure water than from any other cause.

Professor Seely said that, since coming to Cabot, at the farm of their townsman, L. C. Fisher, he had seen stock that were well taken care of. There is something that we should take better care of than our stock—that is, our families, and should improve our houses and their sanitary conditions. He wished the doctor would say something about smut or rusts, blights and mildews, which are transferred from weeds to grain.

Dr. Wiswall—These rusts are a fungoid growth, parasites which take the life of the vegetable and starve it to death.

VARIETY IN THE FARMER'S CULTURE.

BY REV. JAMES K. BABBITT, OF WAITSFIELD.

Dr. Edward Hitchcock, in an address before the Hampshire Agricultural Society, last fall, said: "While 13.12 per cent. of the whole population of the State (Massachusetts) are farmers, 10.39 per cent. of the inmates of our insane hospitals are from the same class of people; and, almost always, under the head of occupation, in the insane hospitals in this country and Europe, we find the farmer and laborer (always) rank among the first in numbers."

He then starts the natural inquiry: "Why is this occupation, by eight per cent. the healthiest of all occupations and trades, the one to furnish so large a proportion of the insane?"

It is not because the work is so much harder than other work, or the light, air and food poorer. Many factory hands are worse conditioned in these respects. Nor is it because of excessive poverty, as is evinced by the fact that paupers do not come chiefly from the farming community- The Doctor accounts for the evil thus:

"The amount of insanity among farmers may be directly traced to incessant care, anxiety and worry, and too little recreation. The farmer carries his loads all the time! He gets up with them on his back in the morning. He puts them in his pockets at meal-times. He puts them in his cart when he goes to his work in the fields. He goes to church and town meeting with them, and places them deep in his heart when he goes to bed at night.

"The mechanic and artisan, much more than the farmer, seek amusement, diversion or recreation, outside of working hours, and, generally, find something of the sort. (But, if two farmers get together, how sombre and melancholy is sure to be their talk. The danger of a short crop is a very handy theme to pitch their tune by. The terribly bad weather will strain up at least one chord in their harp of a thousand strings so that it is ready to break. The "catching" rains of harvest time, the horn and hoof ail will always fetch a lugubrious wail from any farmer; and then the taxes. And, finally, if there be a mortgage on the farm, there is reason enough for bewailing.)

"To be perpetually thinking of one idea, and running on one track is just the thing which upsets the mental balance. One kind of food taken all the time will give awful dyspepsia to any body, and a perpetually blue feeling about our condition, be it correct or not, will give us mental aches that no bodily pain can ever equal."

After this strain and according to this theory the writer goes on. Whether his judgment in the case is correct, his accounting sufficient, or his statements applicable to the farmers of Vermont, and, in particular, to those of Mad

River valley, I will not pretend to say. But the thought he gives us is certainly worth treasuring and examining.

It is possible, we must admit, for one to think so much of the farm as to *neglect the farmer ;* and this, too, in the face of the divine teaching, that " the life is more than meat and the body is more than raiment."

One may give too much of his mind to the meadow, and, in ceaseless attention to the soil, may defraud the soul.

The higher mental and spiritual interests may be crowded aside and badly deranged by an inconsiderate indulgence of the lower interests.

We have known men whose ambition, confessedly, reached no higher than to get a crop off their lands in the easiest and quickest way. Themselves and their families suffered accordingly. Little true thrift and comfort appeared about them.

Others we have known who added the study and application of the most approved methods to their steady industry, to make the farm pay. But their thoughts and efforts being all in one direction, or, at best, but slightly elevated above their labor, they have carried about a very careworn, and, frequently, a very dissatisfied expression.

Farmers, probably, in this, are not sinners above many other classes. But *our paper* has to do with farmers, and that the fault attaches to some of them will hardly be disputed.

A great many are of a much higher type than this. In a community like ours they constitute a very large majority. And to such the thoughts here presented will only be in commendation of their courses, and an encouragement to persevere in their well doing.

The plea we make is that a man shall be treated with as much consideration as his possessions are treated.

A reasoning and reasonable farmer, laying out his plans for work, has two leading thoughts before him—how shall I get the most for my work? and how shall I get this in the most agreeable way?

If two or more means of profit present themselves, he chooses that which he can use to the best advantage.

Tastes and facilities differ. Some enjoy fruit culture, large or small; some have a strong dislike for it, and very little success. Some prefer to raise grain; some, roots; some, grasses; and, all the other conditions being equal, they will engage in the production of what they have a natural aptitude or cultivated ability for.

But the conditions are not always likely to be equal. The fields of a large farm are of a varied character, adapted to produce crops of varying kinds. To put one kind where another would do much better, in every respect, is to labor at a loss. Again, to make the same area do the same service, year after year, furnishing it no help, is to fail of the utmost benefit.

Consequently, agricultural instructors say, suit your planting to the elements and condition of your soil; change the character from time to time, so as to give a chance of recuperation to the soil, or, by some means, put into the soil those elements that are exhausted by the crop Take good care to "keep up the farm." It will run down easily enough by misuse. An undue strain upon it, a careless management of it, are sufficient conditions for spoiling it.

Now a man and his farm are not altogether unlike in the matter of variety in constitution. He is not all bone and muscle, or mind, or spirit, but rather of a *composite* make, into which these and related parts enter; and these principal parts have their sub-divisions or peculiar faculties.

For him to be treated, then, as well as his land is treated, the different departments of his nature must receive attention according to their make. They must be used for what they were designed, rested when they have been long enough used, and supplied with the aliment suited to their health and vigor.

The rest is not properly laziness. One who has long been seated is rested by standing up or walking, and such rest may be a duty. A change of work is often rest, and may be very profitable. The laborer can relieve the body while, at the same time, he stores the mind, and there is gain in both occupations. Both body and intellect frequently find ease and good by that which feeds the taste for music, painting or society, or that which exercises the humane and benevolent sentiments.

Let the whole nature be administered to. This is due.

The body, we will say, is abundantly employed. Is it being worn out too fast? Better is it to wear out than to rust out? Yes; but better still not to wear out beyond any reason or necessity.

As a guard against this the mind must control. Then, certainly, the mind ought to have strength in the variety of its faculties. Here the newspaper comes in as a useful agent. But the newspaper is not enough. Too much in the weekly newspaper is immatured thought or a very partial presentation of facts. High-toned periodicals and standard treatises on valuable themes are of vastly more worth. They will repay study.

A man's bent of mind will direct his choice of strengthening matter. Some people prefer history; some, biography; some, languages; some, mathematics; some, natural science; some, fiction. But, whatever one elects, let it be the best he can get, as he would procure the best seed. And let no one class of aliment or stimulant to the mind be taken all the time. If you would study the science of farming, it is not needful to keep the farm on the brain all the time, nor is it likely to result in the best attainment in the end.

By a change of the object of sight the muscles of the eye are slightly changed, one or more relaxed, another drawn tenser, but there is relief thereby, and one may return to the original object with a steadier sight than before. So, by a diversion, the mental perception is helped, and the ability to perceive fitted to do better work than ever.

'Tis said that Rufus Choate used to refresh himself and prepare for intenser study of the law by reading of a quite contrary character. So are many others profited. So may the farmer be.

The æsthetic and religious natures come in naturally for similar respectful attention, and return a good interest to the farmer.

Many a man is kept on the farm and does well there who, if his early life had been elsewhere, would have undertaken another profession. He loves mechanics, or metaphysics, or theology, or fine arts, or natural history, or politics. Let him not, then, smother these inclinings because of his circumstances, but develop them to his advantage in farming, as far as he may.

It has been sufficiently shown here that a farmer may be a whole man; healthy, industrious, intellectual, sociable, tasteful, sympathetic, religious. And to be such a man is certainly a worthy aim. To use the means to be such, a man is fairly required.

By these facts it is required: The body is likely to do longer and better service. A healthy mind in a healthy body is a proverb that looks in both directions. From such sources true happiness and contentment are wont to come. It relieves manual labor, that might sometimes be only a drudgery, to have some interesting subject of thought to hold easily in the mind. And it seems to me that a farm that has a goodly amount of *intelligent contentment* worked into it must be a better farm than one without it.

The family, too—really a part of the farmer who has one, and a strong arm of assistance or resistance to his efforts—feels the influence of his varied culture, of his strength in thinking as well as laboring, and his appreciation of the beautiful and reverential as well as of the useful and common. Life in such a household is less of a burden than it would otherwise be, and the aspect of affairs there is cheerier and more inviting.

The children catch inspiration from the parents. They perceive that the calling amid which they were born is not all toil and no bliss. It is demonstrated to them as honorable and beneficial, possibly, in every way, not a system of constraint or unholy slavery of body, mind or affection.

Society receives needed assistance from the cultured farmer. He can mingle with the best and hold his place among them. He can join his sympathies with those not so favored as himself. He can talk farm matters, and also something else. He can appreciate a literary effort, a mechanical design, a new discovery, a national revolution, and often the beautiful as well as the good, in song, or harmony, or the other fine arts. Again, the town or State or nation has a use for all the farmers of a high and varied culture. Places wait in the community and commonwealth for such persons. They may serve the people while they still cling to the farm. Or they may leave the farm for a time to serve, and then to return again, and all the while honor their calling and further its true interests. We are a peculiar nation. Some of our best citizens go from the fields to the high official seats and think they do them no dishonor, and oftentimes at length step from these seats to the field and think they do themselves no disgrace. And, what is better, their fellow citizens are of the same mind. Whatever the farmer may think of the professions, the professions, as a rule, think well of the farmer, and honor his worth wherever and whenever it is well shown.

One more benefit in a varied culture is its comfort in advanced life. The professions naturally bring into the mind a variety of topics. The merchant of wide experience becomes acquainted with a broad range of facts. When these men retire from active life, they have their early studies or accumulated information to reflect upon and talk about. They entertain themselves and their friends very happily thereby. Thus they alleviate the approaching burdens of old age. Farmers do after a similar manner sometimes. Why not oftener? When the bodily powers are weakened and the mind left almost unimpaired, why should they be obliged to confine their thoughts or their conversation to the amount of work done in their lifetime and the sports or practices of their youth? If the mind is stored, and the heart, too, spiritually, in youth and maturity, comfort and capability to be of use will endure to the end.

I make not these remarks to *criticise* Vermont farmers. Their character is too well known. My paper is my expression of "God speed to them."

EDUCATIONAL TOPICS.

WHY DOES EDUCATION DRAW YOUNG MEN FROM THE FARM?

BY DR. T. H. HOSKINS, OF NEWPORT.

In looking over the two published volumes of the Reports of this Board of Agriculture, I find that they contain several papers discussing the reasons why young men leave the farm to engage in other operations, instead of devoting themselves to the business of their fathers. In these papers it is deplored as a great evil that so many young men, and, especially, those best educated and most qualified to develop the improved agriculture we so much need, are averse to farm labor, and seek every opportunity to engage in some other business. For a number of years I have been greatly interested in the subject of agricultural education—that is, the preparation of the young farmer for his business, by a course of study in those branches of knowledge, an acquaintance with which would be of direct practical benefit in the various and difficult operations of the farm. But in all my appeals to my brother farmers to take an interest in what seems to me to be a most important matter—one without which we cannot hope to see any great improvement in farming—I have been met by the statement that education only drives young men away from the farm. If, then, I ask an intelligent farmer who has raised this objection whether he believed that ignorance was the best qualification for success in farming, he would say: "Not at all; I am in favor of bringing all the knowledge possible to bear upon the practice of agriculture; I see its benefits every day. I believe in agricultural papers and books, in farmers' clubs, agricultural societies, boards of agriculture, in everything that will increase both scientific and practical knowledge among those who are already farmers. And I would favor the direct training of the young man for farming in an agricultural college, if I saw any prospect of getting him on to a farm after he had completed his college course. But experience shows that young men who have received an academical or collegiate education very rarely engage in farming. It may be different with agricultural colleges, but perhaps we had better wait to see how they succeed in other States before we try it here." If I venture to call his attention to the fact that we already have an agricultural college in our State, he smiles a gentle smile, and says: "I have heard so, but can you show me any of its graduates engaged in farming hereabouts?"

Now I am obliged to confess that it is not our most ignorant farmers—the hard shelled fraternity of scrub farmers—that talk in this way. These objections are urged by our best and most intelligent, practical men. They see the need we all have of more knowledge in our business, but they have serious doubts as to our being able to get that knowledge on to the farm from any educational institutions which are now in existence, even though they may be called agricultural colleges.

I am compelled by daily observation to acknowledge that there is truth in what these good and practical farmers say. And yet I cannot get over wanting to see a closer connection between knowledge and agriculture, through the schools and colleges of the country. I see the men of other avocations educating youth preparatory to their work with success. I see not only the divinity and law and medical and normal schools training the rising generations for their work in these branches, but finding no difficulty, such as the farmers find, in persuading their graduates into the paths in life for which they are fitted. I find the principle being extended into the mechanical branches, so that in the technical schools, such as the Cooper Institute, in New York, the Technological School, of Boston, (which shares with the Massachusetts Agricultural College the income of the funds bestowed by Congress for industrial education in that State,) and similar schools in nearly every large city and many large towns all over the country, turning out students who immediately engage in the very business for which these schools have fitted them, and rapidly rise over the heads of the men who have had only a practical training, and become the great builders, the great contractors, and the leading manufacturers of the day.

Seeing this I cannot help asking what there is in farming which prevents it from sharing in these great benefits to be derived from knowledge imparted to youth, to be used in manhood for the development of the rich resources of the soil.

And when I look further and see that in Europe agricultural education is a success, equally with any other special training, I am still more anxious to inquire what there is in the climate of North America which prevents knowledge from being brought, through the schools, on the farms of this nation. We are not altogether without educated farmers, who are strongly interested in and attached to their work, and highly successful in it. It has occurred to me to inquire what there is special in such cases that prevents education from giving them that distaste for farm life that is said so invariably to accompany scholastic training. I have taken down lists of the names of our successful educated farmers, and have inquired into their antecedents, and the results are certainly curious, and may be instructive. I find in a list of some sixty or seventy successful educated farmers, in New England, New York and Canada, that over one-half of them, nearly two-thirds, are either doctors of medicine, or civil engineers, while of the remainder a considerable proportion are foreigners. Of those who are farmers, pure and simple, every one is mainly self educated, and not one of them is a college graduate.

Perhaps I ought to state here what I mean by "educated" in this connection. I mean by it, possessed of a competent knowledge of the scientific facts which form the basis of successful agricultural practice, and a familiarity with what is being done all over the world for the improvement of agriculture in its various branches. I include also a knowledge of mechanics sufficient to comprehend the mechanical principles embraced in farm work, and the various farm machines now so generally in use. This, in my view, constitutes an educated farmer. He may, and doubtless will have a much wider knowledge than this on many points, since agriculture touches on its various sides the confines of almost every science and every art, and the mind, once fired with the love of knowledge, will not limit itself entirely to any specialty. In my opinion, the training best adapted to form the mind of the young farmer, opens the door not only to learning in his single branch, but puts him on a road that, if followed, will develop the man with a broader and fuller culture than any mere classical or high scientific education, uncombined with applied knowledge, can possibly give.

The fact that so many of our successful educated farmers belong to two professional classes, physicians and civil engineers, is a curious one and one that has to my mind the power of explaining why the education of our higher schools and colleges unfits men for the farm.

The truth is that it unfits them, or, at any rate, does not fit them for those two very departments of life from which our educated farmers come. Our greatest physicians, and our greatest engineers are not college bred men. And in the medical classes the foremost, so far as a pretty extensive experience connected with a medical college allows me to judge, are not the classically educated men who come from the literary colleges.

Medicine is distinguished from the other professions (engineering excepted,) by being not only a science, but a practical art. Physicians have to be skilled manual operators their science is an applied science, and in it their *hands* are educated equally with their *heads.* Without this manual education, which gives us not only the *tactus eruditus*—the "educated touch," upon which such stress is laid by all successful medical educators, but the educated muscle as well, no physician can possibly succeed in the practice of his profession. He has to learn the science of chemistry and apply it to practice in the compounding of medicines, the examination of the excretions and secretions of his patients, and in the cure of cases of poisoning, and their detection when the consequence of criminal acts. He has to learn the science of botany, and apply it in the selection and study of medicinal plants, and, not unfrequently, in their culture. He must, of course, study the science of zoology—the science of animated life, not only as exhibited in men, but in beasts, both in health and disease. He has to cultivate his observing faculties—his perceptive faculties—in this science to a high degree, in order to reach any success in his business. He must cultivate these faculties so that in multitudes of instances he can tell what is the matter with a sick man, or a sick beast, the moment his eye lights upon him, by the way he stands, walks, or lies, by the contour of the muscles, or the expression of the features.

He must be thoroughly conversant with scientific and practical mechanics, since he has to do with the most perfect and wonderful of machines, the human body, and is obliged to know, (and be ready with the knowledge at a moment's notice,) upon mechanical principles, what must be the nature of an injury to a fractured or dislocated bone, and what mechanical principles and instruments must be applied to remedy the evil.

He must understand the science of physiology, which embraces that most important knowledge of the functions of digestion and assimilation of the food, by which all animal bodies are built up and supported, with the nature of their derangements, as well as the remedies therefor. In short, the education of the physician is just that combination of the scientific with the practical which is given to no other profession, much less to the mere classical students of our colleges.

The same is true to a less extent of the special education of our civil engineer. It is from beginning to end the application of science to practice, to actual work in the world.

But it is vastly different in the three other great professions, divinity, law and teaching. What does the divinity student ever learn to do with his hands except gesticulating and baptizing? His culture is entirely of the mind and heart, and is thus a limited culture, that always makes him a one-sided and, usually, an unpractical, though often a morally exemplary man. I do not believe that this is the best training even for a minister, but it is all he ever gets, either in college or the divinity school.

The lawyer in the law school is taught nothing that disciplines any of his bodily powers. Taken as a class, the lawyers are physically the most untrained and helpless people in the world. They do not often have the manual dexterity which would enable them to sign their names in a legible manner. Their whole training is scientific in the highest degree, and in that science, logic, the art of which, argument, is also entirely intellectual. Consequently the better the lawyer the poorer the farmer.

In the profession of teaching the same defect exists, though, as with the clergy, our teachers would receive much benefit from a more practical system of education than they now get. It is because the profession of teaching is so unpractical that it has been found so difficult to make agricultural colleges a success. They have been officered from a class of men utterly unfitted, by training and preconceived opinions, for the work they are set to do, when they are put in charge of a school of agriculture, or of any practical art. As they cannot do it they naturally despise it, and think it unworthy an educated man, according to their idea of education; and all their influence will invariably be used in diverting the course of study from the practical to the rigidly scientific and literary. This is their forte, and they naturally and excusably draw back from that which they neither understand nor value.

The fact is, brother farmers, our colleges and schools were never designed for the likes of us. All the colleges and schools in the world, from the beginning nearly up to the present time, were organized and designed for making priests, ministers, lawyers, and teachers of divinity and law. No thought of educating the people ever entered the minds of the men who founded the schools and colleges of the old world, of which our schools and colleges are the lineal descendants. They were designed for "our betters," as the working men of Europe have always been taught to call the aristocracies of wealth and collegiate learning. In those times the profession of medicine was divided, the scientific part in the hands of the college bred "physician" or doctor of medicine, who disdained to put his hand upon a patient, and was only called in extreme cases to consult with the working men—the so-called apothecaries, and the surgeons—who were also the barbers of the time. The barber's pole of to-day is simply the badge of the barber-surgeon of old, the bleeding staff with which the patient supported his arm while being bled, wound about with the ribbons with which the arm was afterwards bandaged. In those old schools and colleges no arts were ever taught. Abstract science, mathematics, logic and metaphysics, with the languages and literature of two dead and extinct nations, the Greeks and the Romans, were all they taught. The people were not taught at all, and were only considered to be the serfs and the drudges of "their betters." Our ancestors in America are not to be blamed that they only improved a little on the example of their forefathers in organizing the district school, in which the children of the people might be taught to read, write, and cipher a little. They founded academies, too, but these were only as feeders for the colleges, and all the text books, and the whole system of education looked only to making professional men, lawyers, divines and teachers.

The one profession that was at once scientific and practical, that of medicine, had to organize its own schools, and take its own teachers from its own ranks. In these schools were science and art first combined; and always, from the beginning, this was thought, in the old world, to be a degradation; and practitioners of medicine to this day, no matter how learned, are not considered to be the social equals of the members of the other professions. Clergymen and lawyers, almost without number, have been raised to the ranks of the nobility in England, as a reward of eminence in their professions; but this honor yet remains to be for the first time conferred upon a physician, because physicians degrade science and scholarship by applying it to practical use, and actually doing something—though it be only for the relief of suffering humanity—actually doing something with their hands! For this they are declared unfit to stand upon an equality in life with clergymen, lawyers and professors.

In a modified and softened form, it is true, but still potent for evil to a fearful extent, the spirit of those old times has come down to us of to-day, and dominates in our higher institutions of learning, and dictates the methods of teaching in our common schools. It persistently divorces learning from art, and teaches everything abstractly, without showing its relation to use. The result is a general ignorance among the pupils of this system, from the highest to the lowest, of the practical bearing of what they learn. And the consequence is that they learn with difficulty, and forget almost as fast as they learn, what is taught them with so much pains, and at so great an expense of time and money. We all know from daily experience that nothing fixes a fact in the mind like seeing it applied in practice. Many can learn in no other way, though they may have great natural powers of mind; and so we often see the dunces of our schools and colleges among the foremost of men in the practical affairs of life. Schools were of no service to them, but that is the fault of the schools, and of the system upon which their method of imparting instruction is founded.

This great and baneful defect in our common schools, this old world divorce of learning from life, has attracted much attention, caused much severe criticism, and led to some feeble efforts at reform. I take as an example of these efforts one of the text books now in use in our common schools, French's Common School Arithmetic. In the preface of this work, the author states the fact that business men complain that after leaving school they were obliged to learn, and in many cases to devise for themselves methods of computation adapted to their business. The author adds that the universality of this experience led him to a careful and protracted investigation into the philosophy of the mathematical powers of the mind, and to a critical examination into the present methods of teaching arithmetic. From these investigations he became convinced that in order to make practical arithmeticians, a radical change in the plan of text books upon the subject is necessary. Now this is a wonderful, though rather late discovery to make, since the complaint has existed this hundred years and more. But the competition in school books, and the spirit of self interest in their compilers, leads at last to the discovery, and to the serious confession made in this preface, which is equally applicable to every text book upon every branch of knowledge now taught in our schools and colleges.

I do not say that Dr. French, having made this discovery, has not made something of an improvement in his arithmetic, though he goes at it in regular scholastic spirit, beginning with a metaphysical inquiry into "the philosophy of the development of the mathematical powers of the mind," and he comes out pretty much from the hole he went in at, since on the very first leaf of his book he gives a series of definitions of arithmetical terms, in which he uses dozens of words that need defining to the ordinary beginner quite as much as do the terms he uses these words to define. Every definition is, I venture to assert, utterly unintelligible to the average scholar, and will be memorized mechanically, and be of no more use than if they were written in Latin, unless the teacher takes pains to translate them into plain English, and illustrate them practically in various ways. I do not believe a college bred man can make a good arithmetic. When it *is* done it will be done by some practical accountant, and then every college bred man of our schools will, I fear, do his best to prevent its adoption.

Fellow farmers, I think I have made plain to you the reasons why education draws our young men away from the farm. The whole spirit of our educational system, common schools and all, is scholastic, theoretical, and calculated gradually to wean away the youthful mind from every practical aim in life to the dreamy regions of thought without action and life without purpose. So far as it has any practical end it is to beget a contempt for manual labor, and lead to vague ambitions for some sphere in life where kid gloves can be worn all the time. Now in this age and country, when and where, as Horace Greeley has said, there is no way to get money except to earn it or to steal it, our farmer boys are far more likely to be educated into the classes that live by plundering their fathers, either as politicians, speculators or tramps, than to be brought to love and live by the labors of the farm.

Not that there is anything essentially demoralizing in the scholastic system of education. But the ranks of all the professions to which this system is adapted are already crowded to overflowing ; while in any of the industrial occupations no man can command one dollar a month more on account of having received a college education. And when a man cannot command honest employment in the business to which he has been trained, and has been thoroughly disinclined towards any other, there is nothing open to him but to live by his wits, unless he has that rare original genius by which, here and there, a man is able to remodel himself.

To reform the evil to which I have called your attention will require a mighty effort. The first step is that we should understand the necessity that exists for a change. The next is for every man and woman to make a fuss about it, until the change is effected. Nothing can long stand that a majority of the people are continually making a fuss about. Making a fuss is the palladium of our liberties. The people made a fuss about the tyranny of England, and then the revolution. They made a fuss about slavery, and then the emancipation. They are making a fuss about dishonest politics, and thieving politicians are going to the penitentiary. The farmer made a fuss about the middlemen and the railroad, and then reform. We have only to make a fuss, and a big fuss, and keep making a fuss, and we shall have a reformed school system ; and when we get that we may educate our boys and girls as much as we choose, without any fear of educating any of them away from the farm that ought to be there.

I entreat you therefore, brethren, to make a fuss about this matter. Do not let the lawyers and ministers manage your schools without interference. See to it that your children are taught to a better advantage, and in a more practical manner. Demand a better class of text books, and a better training for teachers. Exact a good article, and be willing to pay for it.

It must be understood that in what I have said about colleges and the collegiate method of teaching, I do not seek to arraign individuals, but a system; a system for the existence of which no man now living can be held responsible, but which has come down to us from the dark ages, from the time when it was believed to be of Divine ordinance that a few men should be born into the world, booted and spurred, to ride upon the backs of the rest.

Far from desiring to condemn individuals for accepting, without due thought, a system so seemingly sanctified by time, I would, on the contrary, offer honor to the very considerable number of college professors and college bred men who have recognized, more or less fully, the errors of the system under which they have been bred, have seen its unchristian and anti-republican features, and are now earnestly laboring for its reform. It is particularly among the teachers of natural science, who are brought in these days so closely into relation with the class of manual laborers, and who are, indeed, themselves manual laborers of the highest class, that we find those who are working most earnestly and hopefully to bring about the necessary changes in the method of both popular and high class education. Among them we must rank such professors as the late and the present Secretaries of this Board, who have shown themselves ready to give their time and talents for a pitiful stipend; to come out among us from their laboratories, bringing to our aid, as hand workers, the facts which they and others like them, by both brain work and hand work, have brought to light and applied to practical uses on the farm. Let us honor such men in every possible way, and, by so honoring them, offer the highest encouragement that working men can offer to those who, with self interest and class feeling drawing them the other way, have the nobility and patriotism thus to aid the developments of the national resources, and to add to the individual happiness of every one of the vast multitude who, by such help, may rise from the ignoble and unhappy state of delvers and drudges, hewers of wood and drawers of water, to the full stature of intelligent, cultivated and trained working men.

Perhaps we may hope to draw help also, in time, from the theologians, particularly since that noblest of Christian physicians and missionaries, Robert Livingstone, has taught them that the true way to spread our religion among the heathen is first to teach them the industrial arts. May we not, indeed, hope that they who claim to be the exponents of the faith of that carpenter's Son, whom the common people followed so gladly, may themselves take up the cause of the common people to-day, and, by aiding in their elevation, entitle themselves to the reward of those who give cool water to the thirsty ?

As for the classicists, the logicians, rhetoricians, mathematicians, politicians and magicians,—I mean those who know the black art of coining the sweat and blood of the people into millions for their own coffers,—we may always count upon their fiercest hate and hostility. Their coveted distinction is to be not *of* the people but *above* the people; to be our masters. Even with a free ballot they know they can rule us as long as, by hook and crook, they can maintain a practical monopoly of knowledge. It remains with us to say how long we are going to let them do it.

MISCELLANEOUS SUBJECTS.

THE POTATO DISEASE.

BY C. G. PRINGLE, OF CHARLOTTE.

Certain microscopic plants, apparently insignificant from their exceeding minuteness, preying upon some article of human food, or blighting some staple commodity, have influenced the character and destiny of nations. Thus the vine disease, *Vidium Tuckeri*, first detected in English vineries in 1847, subsequently devastated the vineyards of all Southern and Western Europe, cutting off the principal revenues of many districts, and reducing their population to a condition of want. By greatly reducing the amount of pure wines in commerce, it caused the substitution for these of artificial compounds, burning with alcohol, and caustic with chemical ingredients,—liquors which have begotten a new and more baneful type of intemperance, and have entailed upon civilized nations the curse of delirium tremens.

Another fungus, *Botrytis Bassiana*, caused the muscardine, a disease which for twenty years spread ruin through the silk-worm nurseries, causing inestimable loss, and affecting the price of the important commodity of silk, in all the marts of the world. The plant attacks the interior of the caterpillar, which it finally kills, and twenty-four hours after its death the matured fungus appears under the microscope like a wide forest on the surface of the worm, which looks to the naked eye as though covered with fine flour. All remedies devised against the muscardine had proved fruitless, and just as it was disappearing it was replaced by the *spot*, or *pebrine*, which some naturalists consider to be, also, of vegetable origin.

Another fungus, closely related to the last, *Peronospora infestans*, causes the potato disease, of which this paper treats. This disease was first noticed near Liege in 1842. It rapidly became very malignant, and in a few years had spread into all countries where this important esculent is cultivated. The damage sustained by Great Britain and Ireland in 1845, from this cause, was estimated at not less than £21,000,000, and in the following year it was probably twice that amount. Adapted to furnish, in large quantities and at small cost, a supply of food, the potato had become to the masses of Ireland their staff of life; and when the rot had turned their floury food into a black and reeking mass of putrefaction, famine set the Irish hive swarming. For more than a decade the broad stream of Irish emigration poured to our American shores. It supplied to the wide spread impulse of railroad building, which was beginning to move our nation, the needed means of labor; it added to the heterogeneous compound of our society a new and strong element; it formed in our metropolis a party which long controlled its government; and having re-colonized the Eastern States, as some other parts, bids fair to convert, by virtue of its hardier and more fruitful stock, the New England of our ancestors into a New Ireland of no distant day.

For many years, while the potato disease was committing its severest ravages, little was known with certainty of its character or cause. Many theories, to which attached more or less plausibility, were advanced to account for it; and a long war of words was maintained between those who strove to establish or disprove them. Because the decaying tissues of the affected plants offered to many microscopic forms of animal life an acceptable nidus, and such were found therein, it was believed by many that these infusoria were the cause of the malady. Because the disease raged worst under certain conditions of the weather, others held its origin to be meteoric or electrical. If the causes assigned for the rot were various, the remedies tried by farmers, or suggested by scientific men, were manifold. Ignorant of the true nature of the disease, men groped in darkness for its cure, and tried everything. Liberal rewards were offered for effectual antidotes, were claimed by men who had devised nostrums, but were never awarded. Certain palliatives to a greater or less degree were well proven under all this experiment it is true; and the methods of culture for the potato crop were somewhat modified to advantage.

In the course of time the fungologists directed their microscopes upon diseased potato plants; and discovering the very first indications of the disease in the brown spots on the leaves and stems to consist of a fungus within and upon the tissues of the potato plant, and of the corrosive action of that fungus upon these tissues, announced the true cause of the potato rot. The newly discovered fungus, from its affinity with other previously known forms, was pronounced a *Peronospora*, and received the specific name of *infestans*.

The organs of vegetation of the fungus were, by aid of the microscope, traced through the tissues of leaf, stem, and tuber. These consist, in general with fungi, of elongated cells, placed end to end, and forming continuous threads, more slender than gossamer, and woven together into a loose network, which runs through the whole structure of the infested plant. This network receives the name of *mycelium*, or *spacon*, and performs the functions of both stem and roots. It lives and grows at the expense of the assimilated material of the plant upon which it preys.

The organs of reproduction of the new Peronospora were also observed and described,—those, at least, which are now known to constitute the simplest mode of reproduction. These organs are slender threads, as thin as the threads of the mycelium, which branch from the mycelium, rise usually above the surface of the leaf through its breathing pores, speedily branch in different directions, and finally bear fruit on the tips of their branches. These fruits are usually termed simple spores, or, in technical language, *conidia*, because from their smallness they are dust-like. They are so minute as to be individually imperceptible, and so numerous that it is difficult to conceive a space that may not contain them. These bodies at maturity detach themselves from the mother plant, and being dispersed in the air fall back upon the potato plant, or are borne to others, enter them through their breathing pores, and begin pushing forth the rudimentary cells of a new mycelium. In short, they are capable of germinating and reproducing the species in just the way of any seed. When they fall upon the soil they are unable to germinate there; but if brought by rains in contact with the tubers or the fibrous roots, they may enter these and begin their growth at the foot of their host.

More recently De Bary, one of the most acute and learned of mycologists, discovered in *Peronospora infestans* a second mode of reproduction, far more efficient than the one just described. Some of the branches of the fruit stalk of the fungus, instead of bearing on their stalk simple spores, were by him observed to bear, in their places, pod-like bodies, since named *swarm-spores*, because, on the application of moisture, as supplied by dew or rain, they set free a swarm of from six to sixteen other bodies, known as *zoospores* or living spores, so called because they are furnished with two *cilia*, or hair-like tails, by the help of which they are capable of moving rapidly about, like animacules. These zoospores are best seen when within the swarm-spores; for, when once set free, they are, from the extreme rapidity of their movements, very difficult to make out. This rapid movement usually lasts for about half an hour; and, like the *conidia*, or *simple-spores*, before mentioned, these zoospores generally enter the breathing pores of the leaf and there germinate. It may be noticed, in passing, that this genus of fungi takes its name from a peculiar power which its zoospores possess. Peronospora is the Greek for *boring seed;* and it is not necessary to the success of these zoospores that they should find their way to open breathing pores; for they are capable, when set free, of at once corroding, boring and entering the epidermis or close outer skin of the leaf, or even that of the stalk. When they have ceased to move, their tails or cilia disappear; and, having burst at one end, a transparent tube is protruded, which is a similar mycelium, in every respect, to that produced by the simple spore, and which grows, branches and fruits in precisely the same manner.

Now, though all this had been known respecting the potato fungus, botanists had been sensible, for many years, that much still remained involved in mystery. The great difficulty which beset them was to account for the winter life of the fungus. Simple-spores and swarm-spores are lost in the production of the mycelium; and this fine, thread-like material cannot, of course, survive the frosts and rains of winter, and must utterly perish with the perished leaves and stalks. How, then, is the fungus preserved through the winter? From what beginning, however small, does its life start the succeeding year? These were questions which no fungologist was able to answer. Informed on this point, the cultivator might head off the disease by avoiding the germs, or by attacking it in its infancy. For all the knowledge thus far acquired, this important crop lay much at the mercy of its foe; the great difficulty in the treatment of the disease arising from the fact that the fungus, as far as it was now known, existed within the infested plant, where it could not be got at.

Within the past two years, however, all that remained unknown of the potato fungus has been brought to light; and its entire life-history is now as well understood as that of the commonest plant of our tillage.

In June, 1875, Mr. Worthington G. Smith, of England, an enthusiastic young artist-botanist, aided by suggestions received from Rev. M. J. Berkley, the most eminent of British fungologists, discovered the *resting-spores*, the wintering seeds, of *Peronospora infestans*, learned the mode of their production, and, by aid of his camera lucida, clearly sketched the plant in all its parts.

And, during the past season of 1876, incited thereto by the adverse and somewhat arrogant criticisms of De Bary, with the utmost patience and care, working almost day and night, he has gone over the ground again, and has completely confirmed his previous observations, besides detecting and lucidly sketching several new phases in the life-history of the fungus; and in this his own observations have been sustained, step by step, by the simultaneous and parallel observations of several other acute English cryptogamists. The resting-spores of the previous year, preserved successfully through the winter, have, in numerous cases, been made to germinate and to go through their entire cycle of growth, as previously observed.

A study of other species of Peronospora, allied to the one which produces the potato disease, has revealed the fact of a third mode of reproduction. The simple-spores and swarm-spores, already described, are termed asexual, because they are without sex. Not being formed by the union of the two sexual elements of the plant, they are but as buds, shed off by the mother plant, and only endowed with power to reproduce the plant, as by cuttings, through all the generations possible in a single season. Not being true seeds, capable of preservation, but immediately exhausting themselves in germination, the species must become extinct upon the approach of winter, unless the plant produces spores of a more enduring character than these. In this regard, do these simply-organized plants bear a close analogy to some of the animals of the lower order, as the aphides, or plant lice? The females of these insects, without any intercourse with males—for there are then no males—bring forth living young (similarly fertile females,) throughout the most of the season. Only near the close of summer is there produced a generation of males and females, mingled; and these, uniting, produce the eggs designed to bridge over the winter season for the species, and carry it safely into a succeeding summer.

The third mode of reproduction of the potato fungus, only recently observed, and by Mr. Smith, seems designed for the same end—of preserving the species through the winter. It gives rise to still other bodies, called *oospores* (egg-spores), or, more commonly, resting-spores. These resting-spores are produced by the contact of two sexual, spore-like bodies, the one known as the *antheridium*, which is the male, and is analagous to the anther in flowering plants, and the other called the *oogonium*, being the female and analogous with the ovary of the flower. The oogonium, or female of these two bodies, is like a pod, and contains the oosphere, or egg-sphere, which, being fertilized by the anthiridium (the male), becomes the oospore, (egg-seed,) the true resting-spore. Both these bodies are contained within the tissues of the diseased plant. They are borne upon short foot-stalks, which spring from the mycelial threads. The fertilization of the oosphere within the oogonium is effected by the antheridium, while they are yet attached to the mycelium, or after one or both have become free. When the two bodies accidentally touch, the antheridium forces a small branch or tube into the wall of the oogonium, and discharges into the oosphere a part of its contents. When the oosphere thus fertilized become matured, it is the oospore, or resting-spore.

The perfected resting spore is a slightly egg-shaped body, about one-thousandth of an inch in diameter. It is furnished with two coats, the inner one being termed the *endospore*, and the outer one, which is almost black in color, and strongly warted, the *exospore*. After the potato plant has been destroyed by the fungus, every part of its parasite perishes except the dark brown, warted resting-spores, just described; and these, except such of them as are lodged in the tubers, find their way, through the decay of the leaves and other parts of the affected plant, into the earth to hibernate. When they awake to renewed life in the succeeding summer, they must germinate in the damp, warm earth; and if no potato plants are near, they must perish; but, if they are able to reach these plants with their corrosive mycelium, it penetrates at once the tubers or the roots. Beneath the soil simple and swarm-spores cannot be produced; but into the superior parts of the plant the mycelium soon grows, and produces both these forms of fruit. These are carried through the air into the breathing pores;

and the whole history of the fungus now described is re-enacted.

Now that the entire life history of the potato fungus is known it remains for practical men to turn these discoveries to account; although their work is not the easiest and most hopeful, they need not at least be led off on a wrong track. The destruction of the resting-spores suggests itself as the most direct and certain way to hold the disease in check. If this could be thoroughly effected, the disease could hardly recur the succeeding year; at least it may be practical to prevent its having a strong start. To carefully collect the diseased tops and tubers, and subject them to a sufficient degree of heat would destroy the vitality of the greater part of the resting-spores. When diseased potatoes are fed uncooked to animals, it is probable that the resting-spores which they contain, will, from the firm and close nature of their coats, pass uninjured through the stomachs of the animals, and be widely disseminated with their excrements. By no means ought infected tubers to be used for seed. The fact that the resting-spores winter securely in the soil, teaches that land infested with them should not be replanted to potatoes the following year. Land which from having been often devoted to growing potatoes is unable to yield large, healthy crops of this vegetable,—"potato-sick soil," it is called in England,—has been observed by most farmers of experience. A judicious rotation of different crops, advisable in all cases, cleanses such land, as well as returns to it some exhausted elements of fertility, and enables it again to yield potatoes in abundance.

While making his observations, Mr. Smith found that the fungus developed its mycelium with remarkable rapidity and fruited most abundantly, when he kept the diseased haulms, which were the subjects of his study, in a dish between wet pieces of calico, or in a confined and moist atmosphere under a bell glass. So every farmer has learned to fear warm and wet weather, muggy weather, as conducive to the potato rot. The humidity of the atmosphere is entirely beyond our control, but that of the soil may, by judicious selection or by drainage, be regulated. Too abundant and fat manures tend to produce these fatal conditions, and are, therefore, wisely avoided. Before the days of the rot, potatoes were grown on almost any land that was dry enough to be plowed; but since then land dry enough for corn is allotted to them.

The ravages of the fungus parasitic upon the vine have been nearly abated by dustings of sulphur; and it is quite possible that similar applications, harmless to the potato plant, but fatal to its parasite, will be found out.

The potato disease is an old foe; doubtless, had observations been carefully made, and accurately recorded, all along through the history of the potato, science would now be able to declare with assurance, that this Peronospora, in some form of its manifold life, had clung to it, since its first introduction into Europe. It is an enemy that is always lurking near, ready to work its course of mischief, whenever the conditions of earth, air and plant are favorable to its growth.

OPPORTUNITIES FOR YOUNG FARMERS.

BY COL. JOHN B. MEAD, OF RANDOLPH.

Perhaps, among the many teeming topics which at the present time occupy the minds of agricultural writers and speakers, no one is of more consequence to the future of agriculture itself, or to the interests of those who may pursue it as a calling, than that which relates to the incentives held out and opportunities given to young men to induce them to adopt as a profession the calling of the farmer. And the subject seems so replete with interest to me that I venture at this time to enter upon it, hoping that my words may, at least, be suggestive of some new modes of thought, upon yet untried remedies for what are call *hindrances* to the onward march of human progress. We hear upon every hand the complaint that young men quit the paternal acres, upon arriving at their majority, their heads filled with visionary schemes for rapidly getting wealth, which, to a vast number, through an erroneous education, is the " chief end of man."

The consequence is that the father, feeling slowly creeping over him the infirmities of years, and gradually losing the buoyancy of spirits and the ambition of youth, is led to look with less interest upon the work of his lifetime; performs but a moiety of the labor upon his farm he once did; sees, year by year, his soil diminishing in fertility, his fences and buildings going to gradual but certain decay, and is at last compelled, though against his will, to sell his farm and, perhaps, a fine stock, to which he had become greatly attached, and buy a small place in the village, near to the post office and meeting-house, and there spend the remainder of his days, which, in many instances, we notice, are shortened and greatly impaired in usefulness, because of this prematurely breaking up of his life-associations and occupation.

This, to me, is a source of regret and cause for alarm. Of regret, for the picture is a sad one, as I venture the assertion that in ninety-nine cases of every one hundred where young men leave the farm to seek the good they would possess and enjoy, sooner or later they will candidly admit that the same goal might have been reached, both in honors and in wealth, through patient continuance in well doing at the home of their boyhood.

The fiery ordeals through which the *few* have to pass to attain the heights they aim to reach in wealth and honor, and the perpetual wear and strain upon nerve and fiber are fearful, bringing often in their train a broken constitution and an unhappy closing of a wearisome life.

This, with the premature suspension of active life in the case of the father, and a gradual rusting out of his once, perhaps, brilliant faculties, makes the picture a source of regret to the beholder. It is cause for alarm, for by such means, more, perhaps, than we realize, is the cause of agriculture kept in the background, both as an art and a science, and the calling of the farmer looked upon as mean and degrading—anything but pleasant and lucrative—and far from a position where it rightfully belongs: *on the right of the front rank* among the occupations of men.

For every effect there must have been a cause. This is as true in morals as in minerals. The cause is not always so clearly seen as we might often wish, and we often mistake in searching for it. Among the many that might be named as contributing to the state of things we have pictured may be noticed that to which we have hinted, viz.: *errors in education.*

That a stream cannot rise higher than its fountain is a law of hydrostatics to which we assent. If the farmer rests satisfied with present attainments in his pursuit, or, what is worse, retrogrades—for he cannot stand still—he must not expect his son to become enamored with a calling that has not for its motto, "*Excelsior.*" If he is content with using the same old implements for farm work used by his grandfather or great-grandfather, and left by them in the field when the tocsin of war called them possibly to Bennington, Lexington or Bunker Hill, instead of the more modern and civilized implements of husbandry, he must not be alarmed if his boy, on arriving at twenty-one, and looking about him and into other pursuits, seeing more attractive helps and inviting fields for the display of his fancy and the flights of his genius, concludes to be up with the times and adopts as his life work a more congenial pursuit.

If the farmer ignores the demands of the age, everywhere recognized, for the adoption of labor-saving machinery in the working of the farm; the building of new or rearranging of old barns, for the easier, better and more economical care of the products of the farm, both in stock and produce; if he lets his buildings and fences run down, keeps poor and thriftless stock and neglects it during a long winter, so that it is worth less in spring than it was six months before; if he lets his cattle go a mile for water and his sheep eat snow; if he lets his manures lie scattered about, bleaching in wind and sun, their soluble, and, consequently, more valuable parts be wasted or go down the streams to his more fortunate neighbor below—until, as a legitimate result, he gets fewer crops year by year, and exhibits the *unsightly* spectacle of a shiftless farmer—he need not be surprised if, some morning, John or William says to him, "Father, I am going to quit the farm;" "I don't like the business;" "I can get a living easier, if I can't I don't want any;" and, with such like expressions, he bids good-by to the old farm. The rest of the boys follow suit in due time, and the father, as we have before said, sells out, perhaps to an adjoining neighbor, and retires, not upon a competency, but upon a small stipend, with which, by diligent economy, he ekes out the remainder of his life, which, up to this time, has been an ignominious failure.

Much of this might have been avoided in proper early training in both father and son. The farmer did not well understand his business; never learned that there was any difficulty for a man to be a good farmer; that there were any heights to be attained not already reached by those before him, and so plodded on in the old ways that the latter saw no beauties in the calling—much less the prospect of acquiring a competency, if pursued for life. The father had great faith in the signs of the past, but could not discern the signs of the present. If his father before him sowed his peas or turnips in a particular time of the moon, he was scrupulously careful to do the same; and, contrary to the scripture injunction, he ofttimes regarded the clouds and did not sow, as he should, and, therefore, begged in harvest and had nothing. The son, noticing the spirit of inquiry and research that characterized the men of other pursuits, and the rewards which came in return for such enterprise, was quick to reason from cause to effect, and never having seen great results achieved upon his father's farm, concludes that the same cannot be reached upon *any* farm, and so flies to other and more inviting fields, in which he hopes to make up an estate, arrive at honors and retire.

But we did not design to speak at length upon this branch of our subject further than, by way of contrast, to bring to mind the *opportunities* that now present themselves to young farmers to come to the front and help inaugurate a new state of things in agriculture. The times and seasons now call for a more thorough culture of the soil and the mind.

The present condition of the country is very suggestive, and well calculated to turn the minds of young men in pursuit of a calling to the claims of the original and primitive occupation of man. We have passed one of those epochs in our history that try not only the souls of men but the metal of nations. We have seen, in consequence of the war, a general breaking down of all moral restraint among a large class of our people, leading men to run wild with hazardous and unscrupulous haste into any scheme that promised to enrich themselves, even though it might bankrupt the government that gave them protection; and, as the fruit of such work, we have, to-day, in our land *wrecks*, *moral* and *financial*, on every hand. Men, in hot haste for wealth, have been left to commit great sins with greediness, so that we have at times been led to exclaim, with Jefferson, "I tremble for my country, when I remember that God is just." All good and true men to-day deplore the unsettled condition of affairs in our land, that have come upon us through reckless extravagance in living and doing business, and which, sooner or later, will overwhelm us as a nation, unless we take good heed to our ways in fleeing those hurtful and deceitful lusts which drown men and nations, alike, in destruction and perdition.

There is a general feeling of distrust pervading the minds of men engaged in other professions and pursuits, at the present time, owing to the fluctuations of values and the uncertainties of the currency, amounting almost to despondency, and, in many cases, resulting in bankruptcy; so that a young man, in casting about for the choice of a calling, to-day, sees little that is inviting to his ambition or flattering to his hopes.

Would he be a lawyer? The country, and, I presume, the world is so full of second and third rate men of this profession that almost every village and hamlet can boast of its lawyer before it can of its doctor or minister. For my part, I would sooner dig ditch or pick stones for my daily bread than to do what some of these gentlemen seem obliged to do for a living, viz. : induce their fellow men to go into litigation to settle their difficulties, which, in most cases, could be settled with less than one-half the cost of a law-suit, besides the saving of many heartburnings that often last for a life-time.

All of the profession, of course, do not do this—there are many honorable exceptions, but their ranks are so overcrowded that self-interest leads some to do disreputable things to obtain a livelihood.

Not such are the temptations incident to a farmer's life. No calling is so free from those insidious snares that so often engulf men of other pursuits.

Does our young friend aspire to the enviable distinction of a preacher of the Gospel? If so, we bid him God speed ; for here the harvest is so great and the laborers so few, we dare not hold any back from entering the vineyard, only that we may remind them of the admonition of the Prophet, that some " run before they are sent."

The field of the physician is an important and useful one, and happy is he who wins golden opinions from those whose lives he has been instrumental in prolonging for a season, and whose griefs he has assuaged ; but it is quite a question whether we are not all doctored too much for our good ; at all events, the failures are many and the burdens onerous in this profession.

We might speak of the various other occupations that are useful, many of them indispensable to our mutual comfort, but which have their corresponding drawbacks and discouragements, proving that there is no royal road to fame or wealth.

It is undoubtedly true that much the largest per cent. of men engaged in any one pursuit fail of accomplishing the end for which they toil and strive and suffer, but it is enough for our purpose if we can show to the young man about to choose a calling that the one of the farmer is the freest from care and anxiety, wasting weariness and nervous perplexity of any engaged in by man; that it enables him to hold converse with the mysterious forces that keep the planets in their courses; and that, when so engaged, he is free from those temptations which lead so many astray. When occupied with the labors of the farm, he is constantly reminded of the beneficence of the great Creator, and led, if a reasonable being, from contemplation of his wonders in nature, to view His crowning wonders in the kingdom of grace.

The opportunities to achieve success—for that is what we all aim at—that present themselves to the young farmer of to-day are many, if seized upon while passing. Some of them I will now notice, and, if any boys or young men, now hearing me and yet undecided what calling to adopt, will give me their ears, I will endeavor to say something for their interest.

And, first, let me ask what has been taught you respecting the object and aim of life? What the chief end of man? The shorter catechism *used* to teach us that it was to "glorify God and enjoy Him forever," but many men have been inclined to make that read, "To glorify *self* and *live forever*," and, in endeavoring to carry out such an interpretation have made a failure of their existence. Hear what the scripture saith: "A man's life consisteth not in the abundance of the things he possesseth." It is not all for which we come into this world to heap up riches, not knowing who shall gather them.

The question, "What is the chief good?" has been handed down from the ancients, and the true answer never comes to many until too late to avert shipwreck. I have said it is not wealth. It also is not fame as the world counts fame. This is an empty bubble, that may appear for a day then vanish away. The chief good is to make the most of time and talents while we live, in *getting* and *doing* the *most* that shall benefit humanity. We should all aim to become benefactors to the race, and many are the ways that the farmer can do it; in making two blades of grass grow where one grew before; and by such close application to and experiments with the forces of nature as to induce them to unlock to his gaze still greater mysteries, and pour into his bosom far richer blessings; in beautifying and adorning his home and surroundings, so that all who behold will commend his judgment and admire his taste; in ways without number evincing his love for the beautiful and the true, and in caring for the interests of his neighbors and in keeping down *self* as much as possible in his public and private acts, and so living that, when his course on earth is run, a vacuum shall be felt in the community where he lived, and the mourners shall go about the streets. This, in brief, is the chief good.

Among the opportunities that now call the attention of the young farmer may be noticed the more general diffusion of scientific knowledge by ways of lectures and essays upon topics so near his every day life; so that, if he will but read, he may know more than his teachers of precept and custom. There are heights to be attained in the science of farming, which is yet in its infancy, far beyond the most sanguine expectations and fondest hopes of any among us. How little we know of "how plants grow" or the conditions of soil upon which they depend.

How meagre is our knowledge upon the art of breeding good stock. Most of our efforts in this direction have been at hap-hazard, while the thing itself is governed by as immutable laws as any in the vegetable kingdom. What a field is here for a young farmer to acquire wealth and distinction, if he will but make of it a specialty and a life-work!

I believe in specialties. "What is worth doing at all is worth doing well," is a good motto here. Life is too short to be thorough in every thing, therefore seize upon something for which you have a taste and facilities for pushing to a successful issue.

Take the veterinary science. How few of us know how to treat our animals when sick. To be sure, every one has a remedy when applied to, but how few have intelligent and consistent ones. I was once told, when a boy, to beat a horse with a strip of board upon the bowels, that was sick with the colic. I would not do it. My ready physician did do it, to my utter disgust. I ever after longed for the time when I could pay him, in kind, with interest, for such treatment of my pet horse. I afterwards found, by study, that a dose of aconite or ginger would have been much more merciful, and certain to bring quick relief.

I do not suppose it possible for every farmer to be an expert in treating all diseases of farm stock, for one's practice, we should hope, would be somewhat limited, if confined to his own herd, but let there be one in every neighborhood or school district who shall have given sufficient thought and study to the science as to be able to treat successfully all the known diseases of animals, and who shall be so watchful of symptoms and careful in his conclusions as to be well in hand when some new disease breaks out, like Texas fever in cattle or epizootic in horses.

He can thus do great good among his fellows, and reap a satisfactory recompense, if skillful and honest.

Let another farmer in the vicinity turn his attention to that, to some, most interesting of all subjects—the hybridization or cross breeding of plants. Here is a field, I venture to say, that will call into vigorous exercise all the faculties of his being, needing great patience and indomitable perseverance, with careful study and close observation, but one that will pay in dollars and cents, as well as in enlarged views of nature's processes and a better appreciation of her beauties.

What blessings have already been showered upon the heads of a Goodrich, a Breese, and a Pringle, for their beneficent contributions to the sum total of our enjoyment, in Early Roses and Snowflakes, that tickle our palates and gladden our hearts !

And these gentlemen will tell you that the field they have entered upon is simply boundless, and the results that may yet be obtained through careful research and patient study almost infinite.

We go too much upon the principle that things brought from over the sea and far away are more to be desired than those originated near at home; but far-fetched is too often dear-bought—as witness the Norway oat, together with many other varieties of cereals, advertised so glowingly by such a disinterested personage as Uncle Sam, through the Department at Washington.

If it be true what these gentlemen tell us—and I see no reason to doubt it—that we may, by the art of hybridizing, introduce an almost endless variety of cereals, as improvements on what we now have; if the Flemish Beauty or the Bartlett pear can be changed for the better; if the Early Rose, Early Vermont, Peerless, Snowflake, and such favored esculents must, by and by, give way for more welcome competitors, what opportunities await him who would first herald the news of their advent among us? A grateful people should be willing, at least when goaded on by self-interest, to reward with blessings that are golden and charms that are solid, all such benefactors of the race.

Again, the study of entomology can but be of incalculable benefit to the enterprising farmer. How little we know of the character, habits and ravages of the multiplied forms of insect life that so remorselessly prey upon our crops.

It has been estimated that the damage done in this way is, within the limits of our country, not less than $300,000,000.

Prof. J. B. Turner, of Ohio, says, that the State of Illinois pays out annually from eight to ten millions of dollars for her schools, which is well spent, though not as well as might be. While the best experts inform us that the same State annually loses from ten to twenty millions of dollars from noxious insects, or more than the cost of all her schools; some years several times more. Prof. Perkins, of the Vermont University, says: "There are in the State of Vermont, probably not less than 800 species of Lepidopterous insects, (*i. e.*, moths and butterflies,) and in the whole United States, probably not less than 4,000, and that these constitute but a small part of the injurious insect world. Take, for instance, the vast number of beetles, which include the various tree borers, weevils and curculios; how little do we realize their characters, habits, or the extent of their depredations." President Wilder, of Massachusetts, says: "The study of entomology, as teaching us the habits of insects, both useful and injurious, is of the highest importance in connection with the culture of plants and fruits, and we therefore rejoice in the spirit of enterprise which has, of late, been awakened on this subject. Were we to be told that there was no method to prevent the depredations of insects, we should lie down in despair; but we do little better while we do nothing to prevent them; and if men would give their minds to the subject, most of the evils of which we complain might be prevented." Here is the opinion of a man who has not been content to let others do all his studying and thinking, and as a result has achieved great success as a pomologist. Of course, every farmer cannot be an expert in so intricate a study as this, but if *one* or *two* young farmers in a neighborhood or town would make it a specialty in their school days, and thus fit themselves for practical work when ready to take up the labors of the farm, great good might come to them and their fellows.

Specialties are recognized in other pursuits, and such preparation for particular departments of labor as will enable him who engages therein to approximate to thoroughness if not perfection.

If a young man is going into mercantile operations, he must give not a little of his time, even after he has finished the curriculum of the schools, before he can receive much, if any, wages, and this he does uncomplainingly, because it is the fashion.

If he would be a civil engineer, and attain to a celebrity worth having, he must give long and patient study to that intricate science, and have had considerable practice, before he can be remunerated in proportion to his outlay. But, if he is told that he needs even no better preparation for a calling, where knowledge far more than the schools can give us is needed, he will be astonished, and tell you that it is contrary to his teaching.

And here a word or two to the fathers, who are more or less responsible for this feeling among their sons.

We are creatures of habit and imitators of example. "As is the father so is the son, as is the mother so is her daughter," "Like priest, like people," are teachings enforced by observation, and it becomes you to consider how far, by precept and example, you have taught your boys that the field of the farmer was large enough for the display of a laudable ambition.

Have you not, heretofore, upon seeing any scintillations of genius in your boy, hastened to hie him away into some other pursuit, where, alone, you thought he could achieve name and fame?

This has been in accordance with my observation, and differs only in this, in my own case, when a boy, that he who reared me to manhood kept me too long from school, believing I knew enough to be a farmer, an opinion of which I was then in doubt, and have since most emphatically disproved. One to be a good farmer, as well as a happy man, needs not only a good business, but a scholastic education, and then the patience and industry for a lifetime in study and observation, both in nature's fields and among his books, and he will find ample room for the display of all his faculties, be they ever so brilliant, or his ambition, be it ever so untiring. But I wish, before closing, to point to one or two more opportunities that now are in waiting for the rising young farmer.

There is a great need of more definite knowledge upon many of the operations of the farm. Experiments, to be worth anything, must be more methodical and thorough. We are obliged now to take the "say so," or "guess so," too much, of somebody, as a guide in our manner of conducting our farms. Some one of us will try a certain fertilizer that is upon the market, claiming, with flaming testimonials, our patronage, and utterly fail, because the soil or conditions are so unlike that where success followed; and still we may have used it according to directions. One farmer will tell us he can raise corn anywhere in New England where the soil is suitable, for less than fifty cents a bushel. Another will say that it is the dearest crop he can raise. We want such careful experiments, in every particular in these matters, as shall not lead us astray, and he who can give us unerring conclusions will not go unrewarded. There must be more preparation for achievement in our work if we would elevate the calling to where it rightfully belongs. We are now too often found apologizing for our profession, mourning that its advocates and apostles do not come up to their needed requirements, excusing our inability to do what we are called upon to do in the various walks of life. To be a good farmer one must be a good citizen, ready and active in the duties and responsibilities of the citizen. There is no more limitation to his powers and faculties in these matters, than in the resources of his fields and flocks. Many of the men of other pursuits, while attending to their own business, have more leisure, and, consequently, more time to attend to ours; and while many interests are mutual, many, also, are adverse; and if the representatives of the legal, commercial and manufacturing interests, for instance, do all the thinking for us, and instigate all the legislation, we must not complain when we find ourselves at a disadvantage. If officers of agricultural societies are obliged, when they wish for some one to address the people upon agricultural topics at agricultural fairs, to go to the ranks of the lawyer, editor or minister for a speaker, we must not murmur nor think any less of our calling; for "The fault, dear Brutus, is not in our stars, but in ourselves that we are underlings."

It is a very desirable art to be able to stand before your fellow men and speak with fluency and intelligence upon any given topic, yet very few, comparatively, of our ablest men have been so trained as to do it with ease and grace. The young farmer of to-day, if he will quality himself for this work, and will then, by diligent application, inform himself upon the vital subjects of the times, and, especially, as relating to improved farming, will not have to wait long for invitations to hold forth at picnics, festivals, fairs, and other popular assemblies of his peers, where "feast of reason and flow of soul" make up a part of the entertainment. I speak of this, not to magnify it beyond its worth, for I know that to be able to speak fluently is not always proof of wisdom, and that many of our most useful men in deliberative and popular assemblies are among those who "can't talk," as they say; but how much greater would be their influence ofttimes, if, together with their knowing of a thing, they were able to enforce it with choice language, like "apples of gold in pictures of silver."

I have thus indicated a few of the many opportunities that now are in waiting for the enterprising coming farmer. The theme is a fruitful one, and its fields inviting; but I will close by saying that the farmer needs more than all things else, to be actuated by a lofty moral purpose. "Whatever he attempts to do he should strive to do well," ever realizing the fact that while occupied with the varied industry of his farm, and in close fellowship with nature, the lessons of his calling will not be well heeded if he is not brought into sweet sympathy and harmony with nature's God. Let his query be in search of duty: "What is right?" not what men will say. Let his ambition be, that the world shall be the better for his having lived in it, and, although sometimes moving in a humble sphere while living, dying he shall be remembered among those who have not lived in vain.

THE MERITS OF OUR STATE.

BY M. O. HOWE, OF FAYETTEVILLE.

Though I have what may seem to the lovers of Vermont a suggestive and fruitful topic, yet I must ask you to indulge me in the use of that which is sometimes considered dry and ill-adapted to a public address. I propose to call attention to some statistical facts shown by the census and the Reports of the Department of Agriculture. I have heretofore, with considerable labor in collating from these sources, compared the agricultural products of this State with other States, and have communicated the results of the comparison to the press. The facts may not be new, but they will bear repetition till the merits of our State are better understood and appreciated.

The extremely favorable exhibit of this State, when compared, according to the number of acres improved, and the value of products, with the fertile States of the West, has been a matter of surprise to many. The comparisons that follow are not made to disparage the West, or any portion of our common country. We are all citizens of one great nation, to which we owe the first allegiance. We have an interest in the prosperity of every part of it. Least of all should we disparage our own State. Too many sons and daughters of Vermont have spoken deprecatingly of the land of their birth. Too many have spoken thus through ignorance of its merits. An examination of the statistics referred to will go far to refute the prevalent idea that there is something vastly better in some distant locality than can be found at home. It may be a common fault to underrate that which is near and familiar, and to overvalue that which is distant or far fetched. If we may judge from the number that leave our State to seek for homes elsewhere, this fault appears conspicuously in Vermonters, in the failure to appreciate their native State.

While in other parts of the country the farming interest has been maintained with increasing prosperity, in large portions of this State it has declined for want of hands to man the farms. The methods of farming have improved, but the number of farmers in many of the towns has diminished, and, consequently, the value of farms has depreciated, selling now for no more, and in many cases, when a sale can be made at all, for less than they would have sold for thirty or forty years ago. An increasing number of farmers would keep up the price of farms ; a decreasing number as surely depreciates the price. Other branches of industry suffer in sympathy with agriculture, which is the foundation and support of them all. What is the cause of this decline in so many of our towns ? It may not be the result of a single cause, but there is a principal one apparent above all others, and that is the wholesale emigration that has swept away from the State the natural increase among the farming community. A better knowledge of facts concerning the resources and capacities of the State would have a tendency to check this excessive emigration from which we have suffered so much.

Though the last census shows a gain in the population of the State of about 15,000, the gain was in the villages, —mostly in the large villages,—not upon the farms. From a careful examination of the census, computing the gains in the large towns and villages, as Brattleboro, Burlington, Rutland, St. Albans, &c., I have estimated an actual loss in the agricultural districts. The last census, however, reports an increase in the number engaged in agriculture, which seems to be at variance with the more reliable tables of population, which show a loss of inhabitants in a large number of towns where agriculture is the only important interest. A more thorough enumeration of occupations, at the census of 1870, may account for this discrepancy. It may also be accounted for in part by the fact that there are a largely increased number counted as farmers who have retired to the villages, that are only nominally such ; and a diminished number of minors, laboring at home upon the farms, that are not counted in the census as having occupations. It is evident that, including the owners of farms, we have fewer actual farm laborers than we had twenty or thirty years ago.

I have prepared a table from which may be seen the extent of emigration from our State, and of immigration to it.

	Census of 1870.
Population, in round numbers............	330,000
Natives of Vermont in all the States and Territories........................	421,000
Natives of Vermont remaining in the State,	243,000

Natives of Vermont in other States and Territories	178,000
Residents of the State not natives of it	87,000
Born in the United States	283,000
Born in other States	40,000
Foreign	47,000

It will be seen by this table that while our State has received accessions from other States to the amount of 40,000, and a foreign population of 47,000, making 87,000 residents of the State not natives of it, we have 178,000 natives of Vermont living in other States. Not having the means at hand to ascertain the number of Vermonters in Canada and other foreign countries, they may be estimated at 23,000, making 200,000 natives of Vermont not living in the State. This estimate I believe to be rather below than above the actual number. Some omissions in taking the census would be almost inevitable. There are then 200,000 Vermonters living outside of the State, a number more than equal to four-fifths of all the natives of the State within it. But we fail to comprehend the loss to the State when we look at it in the light of mere numbers. Who were these 200,000? With but few exceptions, they were those in the prime and vigor of youth or manhood. It is because they are not with us that we see the decline in the prosperity of so many towns. It is hardly possible that our population should remain *entirely* stationary; the spirit of enterprise will call for some changes, perhaps for some emigration, but there seems to be no good reason why the immigration to Vermont should not exceed the emigration from it. Had it been only equal, the population of the State would have been 443,000, according to the estimates made. Had the 200,000 natives of Vermont without the State remained within it, it would have given us 530,000 inhabitants.* But had they remained, the impetus given to business throughout the State would have attracted immigrants. Making a lower estimate than is warranted by facts, it is safe to say that had there been no emigration our State would have numbered double her present population. Every department of industry would have felt the effect in increased prosperity. Our unused facilities for manufacturing would have been appropriated and turned to account. Bellows Falls, with its immense water power utilized, might have rivalled Manchester or Lowell. Many of the largest towns might have been no inconsiderable cities, creating a home market for the product of the farms; and the farms themselves, instead of being a drug in the market, salable at no price, would have increased in value to an extent that would have materially added to the wealth of the farming community. With a better appreciation of our homes here in these valleys, and among the mountains, and a less exaggerated conception of what may be found abroad, a condition of the State similar to what I have indicated may yet be realized. Our waste places may be again improved, our abandoned homesteads re-inhabited. If we have places in Vermont that remind us of the lines in Goldsmith's "Deserted Village," where

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* Without making any addition for the families of emigrants that in the case supposed would be counted here.

"The sounds of population fail,
No cheerful murmurs fluctuate in the gale,
No busy steps the grass grown footway tread,
But all the bloomy flash of life is fled.

* * * * * * * * * *

Sunk are thy bowers in shapeless ruin all,
And the long grass o'ertops the mouldering wall,"

We should remember that improved agriculture has, within the last fifty years, made two blades of grass grow where but one grew before, in the country of which the poet wrote, that there every nook and corner of available land is occupied and improved, and that annual rents are paid equal to the price of good lands in Vermont. In like manner, we have reason to believe, our productive lands will in time be wanted, occupied and improved. The more remote hills and mountains, and the rougher portions will be valuable for the growth of wood and timber, for which the progress of the country will create an increasing demand.

But I designed to say more of the 200,000 Vermonters that we miss. What have they gained in material prosperity not attainable in Vermont? They have left behind them their native State and the friends of their youth. There should be some compensation for this. What have they gained? There are things that have value, that are not purchased with dollars and cents. Among these are friends, and the dear associations surrounding the old home that the emigrant leaves in his native State. But this is a view that public opinion ignores. When the inquiry is made, "Can we do better in this or that distant State?" it only means, "Can we accumulate more property there?" not "Is health surer, the associations more agreeable, or the locality better suited to any of the higher or nobler purposes of life?" But taking into consideration the question of property alone, it may well be doubted whether the 200,000 absent Vermonters average any better than they would have averaged at home. We have statistics that throw some light upon this point. By the census of 1870, the value of real and personal property averaged to each individual in

Vermont about	$7 43
Michigan "	6 05
Indiana "	7 00
Wisconsin "	6 47
Minnesota "	5 13
Iowa "	6 00
Kansas "	5 06

It will be seen that the average in Vermont is greater than in any one of the six Western States named. In Illinois, one of the most fertile and wealthy States of the West, excepting the city of Chicago and its neighborhood, the average is about the same as in Vermont. In the older States, having large and wealthy cities, the average, as might be supposed, is somewhat greater.

The value of all the products of the farms averaged to each inhabitant, by the last census, in

Vermont	$104
Michigan	68
Indiana	73
Illinois	83
Wisconsin	74
Minnesota	76
Iowa	95
Kansas	75

The value of all the products of agriculture to each person in Vermont was more than the average to each person in any other State. The next highest was Iowa, with an average of $95 to each inhabitant.

It may be said that the high value of these products *per capita*, in Vermont, is the result of a larger proportion of farms than in other States, but the census shows that about half the States have a larger proportionate number. The per cent. of farmers in the States that have been compared was as follows:

PER. CENT. OF POPULATION ENGAGED IN AGRICULTURE.

Vermont	.53
Michigan	.46
Indiana	.58
Illinois	.50
Wisconsin	.54
Minnesota	.57
Iowa	.61
Kansas	.59

It will be seen that all but two of these seven States have a larger per cent. of population engaged in agriculture than Vermont.

The average value of all the products to each person engaged in agriculture, seems to be a fair test of the relative profit of farming in the different States. Compared according to this standard the average in

Vermont was	$597
Indiana "	460
Wisconsin "	488

Iowa	"	544
Michigan	"	435
Illinois	"	560
Minnesota	"	445
Kansas	"	377

Thus Vermont exceeds all those States in the value of her farm products to each inhabitant engaged in farming. When compared by this test, only four States east of Kansas have a larger product.

By the census of 1860, Vermont produced, according to population, the most butter, cheese, wool and maple sugar.

By the census of 1870, it produced, in like manner, more butter, cheese, maple sugar and potatoes than any other State.

According to the number of acres of improved land, only one State made more butter, only two States produced more hay, one State more potatoes, and three States more wool.

Without regard to size or population, only eight States produce more butter; only two States more cheese, and none as much maple sugar by more than 2,000,000 pounds.

That Vermont exceeds in productiveness the other New England States, is generally understood.

The product of butter and cheese in the New England States, in round numbers, is, by the last census, in

	BUTTER.	CHEESE.
Vermont,	18,000,000 lbs.	8,000,000 lbs.
Mass.,	6,500,000 "	4,000,000 "
N. H.,	6,000,000 "	1,000,000 "
Maine,	11,500,000 "	1,000,000 "
Conn.,	7,000,000 "	2,000,000 "
R. Island,	1,000,000 "	82,000 "

Our State makes nearly three times as much butter as Massachusetts, three times as much as New Hampshire, more than twice as much as Connecticut, and one and one-half times as much as Maine.

Vermont makes almost as much cheese as all the rest of New England.

The general correctness of the census statistics showing the productiveness of this State, are confirmed by the Annual Statistical Reports of the Department of Agriculture. In 1873 the yield of corn per acre was reported for Vermont at thirty-seven and one-half bushels, higher than in any other State, with two exceptions. In 1872 the yield was higher in only four States. In 1868 it was reported higher than in any other State except California. For the same year the yield of wheat per acre was reported at sixteen bushels, being higher than in any other State, with one exception. Only two States are reported for that year as having a higher average yield of potatoes; in the report for 1871 only one State; 1872, five States; 1873, one State.

The lowest yield of corn, per acre, that I have noticed in any year of these reports was exceeded by eleven States, but was then considerably above the average yield per acre of all the States. An examination of these annual reports will show that Vermont is seldom, if ever, reported below an average in the yield, per acre, of any of the farm crops, and, in most of them, usually stands near the head.

Why should a State that facts favor so much lose 200,000 of its population by emigration? Perhaps many have left it entertaining the false idea that it was a hard, sterile and forbidding country. Such an idea has prevailed to a considerable extent. Emigration from the State has been encouraged. It is common to hear it remarked of a young man, especially if of superior merit: "What can he do here? This is no place for him." The question may be answered: "If he is ambitious of large business achievements, the example of the Fairbanks and Esteys shows that opportunities may be improved here."* If he chooses to be one of the farming nobility, the census returns will show him that the average profit to each individual engaged in agriculture is greater in Vermont than in the fertile States of the West. He may be cited to numerous cases where property has been accumulated in this State, by farming alone, to an amount twice, thrice, ten times, or more than the average held by the farmers in those States. In one of the small hill towns adjoining, there is a farmer whose estate is estimated, without exaggeration, at over $50,000; all except an inheritance of about $1,000 made by farming, and made upon that class of hill lands which there is, at present, such a mania for selling or deserting. It may be said of this man, as of others generally that have accumulated property, that he has been content to live in a very simple and unostentatious manner. Had his expenses been as large as many modern farmers', he might have added one more to the number that say: "Farming in Vermont don't pay."

It may be shown by reliable statistics that the value of the products of the farms is greater now than at any former period, if we except a few years during the war. It is said it was once common here for young men to buy farms, running in debt for nearly the whole cost, and paying for them in a few years from the products. That was when pork sold for three to five cents per pound, butter ten to eighteen cents, beef four to five cents. The income from the farms is greater now than then. If there is an unfavorable difference now, it is owing mainly to more expensive habits of living. A respected and venerable citizen of this village, in company with his brother, laid the foundation for a competence, upon a hill farm in a town adjoining, that enabled them to live half their lives without labor. One of their sources of income was raising pork at three cents per pound; never selling for more than five. Instances without number might be given of success achieved here in farming or other business pursuits, above the average of what it is believed has been attained by those that have sought their fortunes abroad.

We have some desirable things in Vermont, not always found in the places to which our emigrants have gone. Some of these, with some of the advantages that our State possesses over the extremely fertile States of the West are:

1. AN ABUNDANCE OF PURE WATER FOR MAN AND BEAST.—Here we have water running from pure springs at almost every house. In level countries this is impossible. In large portions of the West, rain caught upon the roofs, and conveyed to cisterns, is the only dependence for water.

2. PLENTY OF WOOD AND TIMBER WITHIN CONVENIENT DISTANCE.—I have a friend who boasts of a fine prairie farm, in Minnesota. More fortunate than some of his neighbors, he has a wood lot also; but the wood lot is sixteen miles from his house. Thousands of prairie farms have no wood or timber within many miles.

3. HARD ROADS.—Those that have been stuck in the

mud of the deep, rich soil of the grain growing States, will know how to appreciate these.

4. BETTER MARKETS.—It is the value of the products, not the quantity, that indicates the profits of agriculture. There will continue to be the difference of freight and commissions between the markets of the East and the West.

5. EQUAL DISTRIBUTION OF PROPERTY.—In no other State are there so very few poor as in Vermont. In no other State is property so evenly distributed. I am happy to say that we have few very rich, with power to create monopolies and corners in the markets. The accumulation of vast estates in the hands of individuals or corporations is against the interests of the people.

6. A HEALTHFUL CLIMATE. EXEMPTION FROM MALARIAL DISEASES.—Is not this worth taking into account? Thousands of emigrants that might have enjoyed health in Vermont, have had their lives made miserable by the fever and ague, that prevails in large portions of the West.

7 A PLEASANT AND ATTRACTIVE VARIETY OF NATURAL SCENERY.—This is one of the things that cannot well be bought and sold, though some may deem it of no value. I apprehend, however, that there are few with so blunt a perception of what is beautiful in nature, as not to prefer our hills, mountains and valleys, to the dead monotony of a level land.

8. AN EXTENSIVE, AND, AS YET, COMPARATIVELY UNUSED WATER POWER.—The value of manufactured products in this State has increased nearly tenfold within the last twenty-five years. But it is still very small when compared with

the value of such products in Massachusetts, and small compared with what it should be, and may be twenty-five years hence.

The census reports the value of manufactured products in

	1850.	1860.	1870.
Vermont,	$ 3,500,000	$ 16,000,000	$ 32,000,000
Mass.,	65,000,000	266,000,000	553,000,000
N. H.,	23,000,000	45,000,000	71,000,000

The product of manufactures in New Hampshire is more than double that of Vermont. It is about seventeen times greater in Massachusetts, and yet, says J. S. Adams: "The State of Massachusetts, glorious old Commonwealth that she is, has not one single advantage over Vermont, except her seaboard position, that can account for such a difference. Her soil is naturally less fertile, her forests are far less luxuriant and imposing, her hills and mountains are far less abundant and towering, and, of necessity, her natural facilities, in the way of water power for manufacturing purposes, are inferior to those of Vermont. It may be doubted if anywhere on the face of the earth can be found a section of country where the conjunction of a rich soil, an abundance of the finest forests, and a universal distribution of water power, all indicate more plainly than in Vermont, an adaptation for an unlimited development of manufacturing industry."

The value of the annual product of manufactures in Massachusetts is more than one-fourth of the value of all the real and personal property in that State. It is more than double the whole value of all the real and personal property of Vermont. If an amount of manufacturing was carried on in this State equal to that in Massachusetts, it would add enormously to the wealth of the State. If only half as much, the annual product would more than equal in value all the real and personal property of the State. If, then, our fertile soil furnishes a too limited opportunity to the people of the State so that they must needs emigrate, here is another vast field for enterprise within the State, awaiting occupation. We need immigrants instead of sending emigrants away.

We have our full share, here in Vermont, of that which is desirable, and which should bind our people to their homes. Attachment to a permanent place of abode deserves to be classed among the virtues. When a person is fixed in the locality where he means to live and die, the influence of that intent can hardly fail to make him a better citizen. He has motives for well doing that are not felt by another who means to sell out at the first opportunity, and remove to a distant State. He feels more the need of mutual assistance and good will among the people with whom he intends permanently to abide. He feels a greater interest in the improvement of the soil, in the culture of fruit, and in all the surroundings of his home where he intends to remain to reap the benefits of his improvements; and thus, while seeking his own interests, he promotes that of his neighborhood and the State.

I am not alone in the opinion that Vermont is a desirable State, not to emigrate from, but for a home. We frequently see words commendatory of our State, from people of intelligence and culture, who have seen much of the world. The familiar words of Horace Greeley: " Go West, young man," have become proverbial. Not so his deliberately expressed opinion,—after an extensive acquaintance in the different States,—that nowhere in the country would a given amount of money bring more substantial comforts to those seeking homes, than when invested in a Vermont farm.

Says a newspaper writer: "One of the largest and most successful working farmers in Windsor County, (a European by birth, travelled extensively, and at last found himself here, and penniless; went to farming, reared a large family, and made a good fortune;) once remarked to the writer, 'that there was no place on earth where God had given to man so many blessings, and at so cheap a rate as in Vermont.' Many others who might immigrate to us would find this true. Our hills and valleys inspire the youth to high aims; our mountains and rocks are something to fasten upon; they are mental and moral helps which are wanting in the West. The Vermonter may make the circle of the globe and never, till he again sets foot among his native hills, will he be able to quaff so pure a draught of cold water as from her crystal springs, or breathe a purer, freer air than sweeps her fields."

WINDOW GARDENING.

BY MRS. W. C. WHIPPLE, OF POMFRET.

I hardly expect, in this talk upon window gardening, to interest only those who make the cultivation of plants in the house a study—that means success; and, to do this, one must not only admire but love them. Then the labor of taking care of them is no hardship, but a pastime.

There are very many farmers' wives, especially those who make butter-making a specialty, who are obliged to be almost constantly at home, and who cannot be entirely satisfied without some means of lifting their minds, now and then, from the regular routine of milk-skimming, cooking, etc., and, at times, getting a little out-door exercise, withal—and what is there better calculated to do this, particularly to the true lover of flowers, than the cultivation of them?—besides, they add so much to the adornment of our homes that even those who sneer at the means used and time spent can but admire and feel delighted with the sight of vigorous and well-kept plants in winter.

Every one who cares enough for them to get them, wants them to grow and do their best, if possible; and, to gain this end, there are certain conditions—proper soil, air, light, heat, etc.—that must be complied with, and, in order to know what these are with different varieties, one must have experience—for I have found that no common amount of reading will save all your plants, for this reason: means that would work like a charm in the hands of a good florist, would, in many cases, prove utter failures with the inexperienced or amateurs.

For this reason, I feel my inability to do this subject justice, but, if what I have learned in the short time I have been experimenting will be the means of saving some one's beauties to them, I shall be glad, for I know how hard it is to get a nice plant and just begin to enjoy it and the prospect of what it will be, and then have it droop and die, while you are totally ignorant of what to do to save it. But still I do not know but a small amount of this disappointment is necessary to stimulate one to try and study into their wants and necessities.

To commence with, I made geraniums almost a specialty, having some one hundred different varieties. I chose these on account of their general hardiness and ease of culture, and, by getting the very dwarf varieties, I could not only accommodate them better in the windows, but found them more abundant blossomers, and also having larger, fairer blossoms than the tall-growing ones—and here I would say that many of my acquaintances would hear of the number I had and come to see them, expecting, of course, that they must about fill the house, and I could see, at once, their disappointment at the show they did not make. Nevertheless, I consider them far superior for house culture, and some of them just as good for bedding out.

I have found a black, sandy peat the best soil I have ever tried for these, one that, by the help of the farmer's fertilizer, will bring out plenty of good sized flowers, that is, if they can have a few hours of sunshine a day and a plenty of fresh air. As these are not troubled with insects, with the exception of the white mite, in the earth, the daily watering with an occasional showering of the foliage is all that is required.

For the mite, I find the ashes from tobacco an effectual remedy, and as *pater-familias* at our house indulges in a cigar now and then, it is very easy to look up the plants that need and set in his reach—they then become useful to each other.

This white mite is made by a small brown fly, and to destroy this one must fumigate with tobacco.

Those of the geraniums we keep for the beauty of the foliage, and the ivy leaved, need to be kept quite near the glass to bring out the rich coloring, and you must nip every bud unless you wish to lose leaves. The only chance of a failure to get a fair amount of blossoms with these or almost all varieties of blooming plants, in winter, is in not getting your cuttings started early enough to have them get strong, healthy roots, and plenty of them, before they are confined entirely to the house. No one need expect a plant to bloom well that is not well started by the middle of June.

Now a word in regard to starting cuttings may not be out of place. I have the best success in putting them by the edge of a porous pot, one that is white and unglazed upon the inside, in the sandy peat, and, if they are well taken off—that is, if the germ of the root, as I call it, is not left on the old plant—one may have a right to expect all to live, with the same amount of light and air they need while growing. There are some kinds, like the tradescantia, coleus, etc., that start quicker in water. With these it is only necessary to be cut off just below a joint, to have them start readily.

Many people think it almost impossible to start cuttings in winter, but I think it a mistake, as I have started quite a number of geraniums, pelargoniums, fuchsias and lantanas this winter. The past year I have procured quite a number of different varieties of begonias, some for the beauty of their foliage and others for their different colored blossoms. These, I find, thrive best in a warm and shady situation, and want more sand in the earth—about two-thirds sand and the rest rich loam, with plenty of charcoal for drainage. They like a moist atmosphere, but not much water on the roots, so I shower the foliage often with warm water, being careful to avoid getting much into the pot. I have never found any insect that troubles these; but, if they are put into too rich earth or kept too wet, the roots will decay and the stalks drop off just above a joint, and it is considerably so with the Chinese primrose if kept too moist; but the primrose will not bear water on its leaves at all.

My first primrose—poor thing! how hard I tried to make it live—but, instead, was killing it with mistaken kindness. I had read in the florist's book of instructions: "Primroses delight in a rich, sandy soil and moist atmosphere."

" Well," I said, " I can substitute for the moisture repeated showerings, and, by setting it in the sunshine, I'll get something of a moist atmosphere about it; also my begonia rex. I know they grew well in the moist atmosphere of fern cases, so I'll put it by the side of my primrose, and so kill two birds with one stone"—and, most assuredly, I did, beyond any future resurrection, too.

I think the double white primrose more sensitive to ill treatment than the single varieties, and is not apt to do quite as well with other plants in the window, but neither kind will bear crowding.

I have a poinsettia pulcherrima that has been quite a beauty this winter, if arranged in with other plants so as to cover the bare stalk, and thus hide another of my blunders, also my ignorance of botany—for, had I been well read in that, I might, perhaps, have detected the difference between the embryo flower bract and the common leaves, and not re-potted it in just the wrong time, as I did.

I had been told, by a person whom I supposed knew, that a poinsettia would not be likely to bloom until two years old. Mine not being of that age, and knowing it usually dropped its leaves and rested through the winter, I concluded I would re-pot it about the middle of November, set it away and make room for some other plant that needed the sunlight. In a short time, however, I saw my mistake, but too late to save any of the green leaves that help so much to set off the bright scarlet ones that surround the flower proper.

Any one that has a warm, sunny window can grow these if the temperature of the room does not run too low at night, and, as their name indicates, are very beautiful, beside lasting a long time in flower.

The acacia, too, is another shrub of easy culture, with much prettier foliage and quicker growth than the oleander, and having quite pretty and fragrant flowers.

There is the trailing abutelon, with pretty lance-shaped and marbled leaves, which requires no peculiar treatment, likes considerable water, and, of course, must have a soil that will not get sodden and sour, as all other plants of this character should.

I have a few tea and china roses, but they are young, and I have only experimented a little with them, but enough to be convinced that they do much better in a soil of burnt sod than any other I know of. Any good, rich sod, burnt till it will feel like ashes, and light enough to crumble through your fingers.

I hear that one of my neighbors is trying a fuchsia in it, and that it is doing well. I am inclined to believe that it is just as good for those as roses, as both are lovers of alkali and enormous eaters.

I have been a good deal troubled with the red spider on my roses, and from them they traveled to my fuchsias. Being unable to get the whale oil soap to kill them with, I tried spirits of camphor and water (one-half teaspoonful to one quart of water) with very good success. As that has a tendency to revive a drooping plant, as well as persons, I think it, on the whole, preferable.

With the roses—they being more woody—I had the water heated to about one hundred and twenty degrees and in a deep pail, and gave them a quick plunge, repeating it two or three times in the day, and once every day until cured for that time.

Florists tell you spiders can't thrive only in the hot, dry air of living rooms, but I don't believe it, though, for there has been but very few of the plants that are liable to be afflicted with them, that I have received from the conservatory, but what I could find the traces, if not the insects, already on them. I have kept my roses in the kitchen, where there is an abundance of steam and fresh air constantly, still I am obliged to watch and fight them yet, and expect to until they are thoroughly acclimated to house culture.

Persons that have been accustomed to cultivate roses or other plants that have been raised for generations back (generations of plants, I mean,) in the house, till they have become perfectly adapted to that kind of cultivation, know but very little what it is to to take the tender varieties, direct from the hands of a good florist and the even temperature of a conservatory, and make them live, even, through the process of acclimation, especially so if sent you by mail; and perhaps a word here in regard to the treatment of such will be of service to some one.

I have had the best success to remove the moss and plunge them for an hour or two in warm water, foliage and all, or longer if at all dry when received; after this take any light, sandy soil and the smallest clay pot that will accommodate the roots, with a very little soil, and charcoal for the drainage at the bottom; say one about two inches across the top, inside, for a plant six inches or less in height. This is to encourage new action in the roots; and I have found, by inquiring, that this is a principle all florists act upon, with all kinds of plants, where the growth has been checked from any cause; for, if you give more soil than is actually needed to a plant, where a share of the roots are inactive, it damages the active ones by getting sour, on account of not taking up the moisture contained in it.

After potting, set in the shade for a day or two; or, if in winter, on a window after the direct rays of the sun have passed, for this reason: the air of our rooms is not apt to be as pure and fresh in winter, and the sun will correct this in a measure where it has a chance. I have found it necessary sometimes to fasten a newspaper up to the window, and let it hang over on the inside, next to the room, forming a hood like, facing the light and over the plants, thus excluding the heated air of the room, in a measure, also insuring a little more moisture to the invalids; but one must have a care to let in fresh air occasionally, as this is about the only medicine they will accept of at first.

Then, in a few days, if they keep comfortable looking, you can give them a little stronger sunlight, by letting them remain there while the sun shines in that direction, by putting a thin curtain between them and the glass. In a week or ten days more, if they are naturally robust, the roots will have started enough to re-pot them into a size larger pot, first giving them a good watering.

In case they are quite stocky and dwarfish to begin with, it might, perhaps, be preferable to put them into two or three sizes larger pots, and so avoid re-potting them too many times, as every one of much experience knows re-potting tends to make them send out side shoots instead of upright ones. I have fancied, too, that they were rather impatient at being moved about very much in different positions, particularly the begonias, until they are quite strong again.

I would like to say a word in regard to bouvardias. I had a few varieties last spring that had blossomed through the winter, and thought best to bed them out, hoping, by care in taking them from the pot, not to disturb the roots so but what I could take them in again for this winter.

Among the different ones was one elegans, which I did not admire as much as the others, and perhaps did not handle it quite as carefully, for I noticed I broke some of the roots; but my white one, so waxy and fragrant, was put into the ground very carefully, I assure you, not a *thread of a root broken.* (Ignorance and inexperience again.) In a few weeks elegans threw up strong, healthy shoots from the roots, but my pet not one. When it came time to take them up, in the fall, I did so, but all *but elegans died.* That has blossomed well all winter.

Now, I know, as these do not start from cuttings, it is by breaking the root or a division of them that you start new ones for the next winter.

I have spoken more particularly of my *failures*, and now, by taking into consideration that I have only common sitting room and kitchen windows, such as almost any farmer's wife has, you can judge for yourselves, by the few plants I have here, of my success.

Hoping I have not trespassed too largely upon time that could surely be more ably and perhaps more profitably spent, and feeling grateful to those who have been made martyrs of for the enjoyment of the few, I will adjourn this till I meet some of my particular friends who love to talk of plants as well as I do.

INSECTS INJURIOUS TO THE POTATO AND APPLE.

BY GEORGE H. PERKINS, PH. D.,

PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF VERMONT AND STATE AGRICULTURAL COLLEGE.

Every person who attempts to cultivate any kind of tree or plant very soon finds that if he would have even moderate success, he must watch for and drive away, or destroy, many kinds of insects. In the cultivation of many plants, and those which are most important economically are among the number, the fight with insect foes is an unceasing one, and unless the agriculturist have some knowledge of the habits of his foes, and of remedies against their attacks, he will be very likely to be beaten.

Proper seed, suitable fertilizers, the best time to plant, are all important, and without knowledge of these the farmer cannot succeed, but, after all, of what avail is the fullest knowledge of all these things, if there be utter ignorance respecting the character and habits of the insects that stand eager to devour every blade as soon as it appears above ground, every bud as soon as it unfolds, or even before? All preliminary work, however well done, is of no value whatever if the crop be wholly destroyed before it can be gathered. Vigilance, energy, knowledge, are all needed in keeping off insects as much as in any other part of agriculture. I think that few cultivators will question this, and yet how few there are that have taken the trouble to inform themselves as to the structure, use, or injuriousness, habits, etc., of any one of the many insects that every year infest their orchards and fields! According to carefully collected statistics, the losses in this country from the ravages of insects are enormous. From the best statistics that he could obtain, Riley estimates the damage done by the chinch bug in Missouri alone, in 1874, at not less than $19,000,000. No one, so far as I know, has ever estimated the losses from the attacks of potato bugs, or many others of our worst depredators, but it is certain that in many States the loss in crops destroyed by these insects, Hessian flies, chinch bugs, army worms, canker worms, and all the rest, amount annually to millions of dollars. Those best acquainted with the subject and best able to form a fair estimate, declare that the annual losses in the United States amount to from three to five hundred millions of dollars. A freshet or tornado which should destroy in any single State of the Union as much property as insects do every year, would arouse the people to seek means of preventing a re currence of the disaster, and yet in the face of such losses as those named, the majority of those most immediately concerned sit as if helpless and try to bear them as philosophically as they can. They seem to think that not much can be done to prevent them, that like a wet season or a late spring they must be endured. I do not pretend to say that all, or even most of these losses could be prevented, but I do say most emphatically that if proper measures are adopted, a great deal may be done. If every State had a competent entomologist, as only three or four States now have, one who could give time to the work and who would secure the co-operation of the farmers in his work, millions of dollars might be saved to our country. But without this much may be done, though far less than might be. The greater his knowledge of insects the more successfully will the farmer and fruit grower fight them, but he need not wait a day. Let him get all the knowledge he can from books, but meanwhile set to work and get what he can from insects themselves, and make his enemies teach him how to destroy them. If, as the farmer looks over his fields, he will carefully examine every plant that has suddenly wilted, or turned black or yellow, and examine the earth about it he may often not only discover the cause of injury, but something of the habits of the injurer, and a knowledge of its habits is the first step towards its eradication. In a paper on "Birds in Their Relation to Agriculture," in the first Report of this Board, I have alluded to the useful habits of many birds as insect destroyers, and every year I am more and more thoroughly convinced that no words can too strongly declare the value of birds as aids to the agriculturist. There is much that might be said upon this subject, but I can now only emphasize what has been said elsewhere.

I shall have occasion in course of the following pages to speak frequently of hand picking, and I wish to say here that, from what I have seen and heard from good authority, I believe that this mode of dealing with many insects is far more efficient and less troublesome than is usually believed. At first sight it seems a very laborious and tedious task to pick one by one hundreds of thousands, it may be, of worms or bugs from plants or trees, but yet hand picking has been actually tried more than once within a short time on a large scale and the labor has been very fully rewarded in every instance, the toil being less and the advantage greater than was expected. There are many insects that can not be thus dealt with, but many can, and I have recommended it in no case in which it has not, to my own knowledge, been tried with success. I think that hand picking might be profitably attempted, at least on a small scale, in very many cases where it is not thought of.

Many persons in their zeal to remove the troublesome insects that swarm over their plants, crush indiscriminately every insect that comes in their way, and perhaps this is the best thing that some can do, but a little knowledge would be a great help here, for there are useful insects as well as injurious ones, and it is as bad to destroy a friend as to fail to destroy an enemy. I do not think that crushing insects is the best mode of destroying them. Some beetles, if crushed by the finger, may cause sores, especially if the skin be scratched or broken, yet this is not of very great importance, as such injury is not likely to be great, but if a female full of eggs be crushed and left, the eggs may hatch as well as if laid naturally, and so no good be done. Worms and grubs of all sorts may, of course, be crushed between the thumb and finger, if one is not particular as to the condition of his hands, but scalding is better, and the best and most effectual method of destroying any insect is to burn it. A hot fire is one of the few things from which an insect cannot escape. Sometimes a caterpillar, or grub, or even the adult insect may be found covered with whitish or yellow bodies of an oval or spherical shape. Such specimens should always be left to their own destruction, for those little bodies are invariably the eggs, or chrysalids of parasites that will surely accomplish the destruction, not only of the one larva on which they may be found, but by their development and increase they may help largely to keep in check other like pests. Another point I wish to notice. It makes a great difference with your success in battling against insects how well your neighbors care for their trees and crops, and it makes a great difference with them how well you care for yours. It is very discouraging to a farmer who uses all his ingenuity to rid his trees and plants of troublesome insects to have his next neighbor's grounds a safe retreat for all sorts of bugs and worms, and a recruiting station from which fresh hordes may pour upon his newly cleaned trees and the crops from which he has toilsomely picked the insects. This is a matter of a great deal of importance. By concerted, rational endeavor, I believe the agriculturists may gain the victory, at least a partial victory, over the insect armies that beset them on all sides. But if the work must be done by one here and another there it goes on slowly and with many defects.

I cannot here take space to speak of the scientific classification of insects, and of the different sub-orders. Every agriculturist should possess such works as Harris' "Insects Injurious to Vegetation," and Packard's "Guide to the Study of Insects," and in such works this will be found. But, as I shall be obliged to use several technical terms frequently, it may be well to explain them here. On taking an insect in the hand it will be seen that the body is divided into three parts, the head bearing the eyes, feelers, mouth parts, etc., the thorax, which is usually much larger and to which the wings and legs are attached, and lastly, a longer and larger portion, the abdomen, and these three terms will be often used in the following pages. The head and thorax are sometimes very closely united so that they do not at first seem distinct, but there is usually no trouble in distinguishing them, and the abdomen is rarely so closely united to the thorax that its line of separation cannot be seen. Insects are found in three different states. When an insect comes from the egg it is usually more or less worm-like in appearance, and is then called a larva, such as any caterpillar, the army worm, various grubs, etc. After living for sometime in this state, eating enormously and growing very rapidly insects pass into the next, the chrysalis, or pupa state, a state of inactivity, and from the chrysalis they come forth fully grown and developed forms, the adult or imago condition. Sometimes an insect does not change much in form and appearance as it passes from one state to another. This is true of locusts, while others, like the butterflies, are wholly different in appearance in each of the three states.

As the space at my disposal is necessarily limited, I am unable to do much more than make a beginning of the work of describing the injurious insects of this State. Almost every species of plant and tree in the State is attacked by one or more distinct species of insects. While I fully believe that complete accounts of all these, with suggestions as to their destruction, would be of very great value to the people of the State, as well as a like enumeration and description of those insects that are useful, it is impossible to do this in a few pages. From a considerable quantity of material I have selected, as being most useful, the accounts that follow, believing that a tolerably thorough treatment of those insects that attack the potato and the apple, two of our most important crops, would be of greater value on the whole than less complete accounts of a greater number of insects, hoping that there may hereafter be opportunity to extend the subject over a wider field.

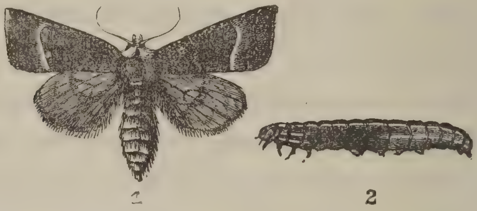
In considering

INSECTS INJURIOUS TO THE POTATO

we must enumerate quite a number of different species, some of them far more injurious than others, but all worthy of careful study. I propose to mention nearly all the different insects that have within the last few years done any considerable damage to the potato in the Northern United States. Some of these never have, and probably never will enter this State, the climatic or other conditions being too unfavorable. Others, though never yet found among us, may appear at almost any time, while yet others have been known in the State as long as the vegetable has been cultivated.

Of course it will be best to devote most of our attention to such species as are most likely to affect our own crops. Among the Lepidoptera—the group embracing moths and butterflies—there are several species that do more or less damage to the potato, although not usually very troublesome as compared with some other insects. One of these, a small moth (*Gortyna nitela, Guen*)*, burrows in the larvæ state in the stalks of the potato, and also in those of other plants.

FIG. 1.



STALK-BORER—GORTYNA NITELA.—*Guen.*

1. perfect moth; 2. larva.

The moth is about an inch and a half across the expanded wings. It is of a gray color, the fore wings finely sprinkled with yellow and having a light line across them near the outer end. As the stalks soon wilt when bored by these larvæ, which are one and one-half inches long, of a light purplish color with light longitudinal stripes, the cultivator can easily find them, and by cutting off the stalk destroy them. This insect has, I believe, been found in Massachusetts, and perhaps in this State, but its ravages have not been extensive.

A somewhat similar moth has as its larva one of the cut worms. It is smaller than the preceding, having a spread of wings of one and one-fourth inches. This moth (*Agrotis tessellata, Harris*,) is dark colored, the fore wings being of dark grayish, with a triangular and a square black spot alternating with lighter spots, and near the body is another small black spot. The hind wings are black, or very dark below and gray above. The larva of this moth is sometimes called the gray grub. It appears in the spring about the first of June. During the day it remains concealed in the earth coming out to feed by night, eating, besides potatoes, beans, cabbages, and some other vegetables. The larva is from three-fourths of an inch to one and one-fourth inches long. A number captured on the thirteenth of June attained maturity on the twenty-fifth, when they ceased to eat and soon after buried themselves in the ground and changed to chrysalids. These were a dark brown color and were enclosed in a case made of minute grains of sand glued together. This case was considerably larger than the chrysalis. On the sixteenth of July perfect moths began to appear, and during the week continued to emerge from the chrysalids. I am inclined to believe that this moth does not ordinarily do great damage to potatoes, but if many of them existed in a garden they would undoubtedly destroy many plants.

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* Electrotypes for this and the following figures were obtained from Prof. C. V. RILEY, State Entomologist of Missouri.

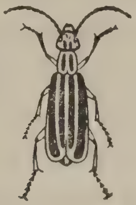
Another quite similar pest is that known as the greasy cut worm (*Agrotis suffusa*, *D. and S.*), but this attacks other plants quite as readily as the potato, though this is not wholly distasteful to it. The only remedy against cut worms seems to be that of searching them out and destroying them. The wilting of plants and the sure indications of their presence guide the cultivator to their hiding places, and this method has been very advantageously employed in large cornfields. Robins, more I think than any other bird, are useful in destroying the cut worms of various species.

Another insect that sometimes does some damage to the potato crop is the five spotted sphinx (*Macrosila quinque maculata*, *Haw.*), the larva of which is the common large potato or tomato worm. This worm from its size and somewhat belligerent appearance is sometimes feared and thought to be poisonous, but it is really an entirely harmless insect so far as handling it is concerned. The great size and comparatively small numbers of the worm, make hand picking easy, and in this way its ravages, when they occur, may be checked.

Far more destructive than any of the moths to the potato are several species of beetles, or Coleoptera—a group of vast size, embracing in all probability not less than eighty thousand distinct species. The beetles are for the most part easily distinguished by the hard, shell-like upper wings, beneath which are folded the thinner under pair, which alone serve for flight. Not all the beetles injurious to the potato are found in New England, but quite a number are, or probably soon will be.

There is one of the curculios (*Baridius trinotatus*, *Say.*), which in the Southern, Middle and Western States has ruined many potatoes. The beetle is about one-fourth of an inch long, of a bluish gray with three shining black spots on the thorax. The female bores into the stalk of the potato and lays in it her egg, and as soon as hatched the larva bores down towards the ground ruining the vines. If the vines are all burned as soon as they wilt this insect may be destroyed. It has not yet appeared in New England.

FIG. 2.



STRIPED BLISTER BEETLE—LYTTA VITTATA.—*Fabr.*

There is quite a large group of beetles known as blistering beetles. These are mostly long, narrow insects running or flying with speed. They are not of large size—from three-fourths of an inch to one inch long—the wing covers are less rigid than in most beetles, and when crushed and applied to the skin they produce blisters. Perhaps the most common of these beetles in the United States is the striped blister beetle (*Lytta vittata*, *Fabr*). The moths attack vegetation only in the larval or caterpillar state, while the beetles may attack it in either the larval or perfect state, or both. The striped blister beetle only attacks the potato in the perfect state. The beetle is of a reddish yellow above, with two black stripes on the thorax, and on each wing cover, and two black spots on the head. The under side of the body is black, as are the legs, and covered with grayish down. It is from one-half to three-fourths of an inch long and about one-fourth of an inch wide. I do not know that this beetle has ever committed great ravages in Vermont, but the fact that it exists in the State, and that in the West it has done in some places very great mischief warns us to keep watch of it, and should it appear anywhere in unusual numbers, immediate measures should be taken for its destruction. I have seen large patches of potatoes in Central Illinois swarming with this beetle, and more than once in places where the Colorado beetle had not done very great damage this has come and wholly destroyed the crop. It seems to be somewhat periodical in its attacks, for some seasons it will be quite scarce, and others very abundant. Aside from the Colorado beetle, this striped blister beetle has done far more injury to potatoes than any other insect. As remedies against this beetle, Paris green would probably be effectual, but it is less expensive and troublesome to drive them off into a fire. In the hot part of the day these beetles take flight very readily, and if straw or hay be strewed around the field, they will most of them take refuge in it if driven from the potatoes, and may then be burned with it. This method has sometimes, I believe usually, proved entirely satisfactory, and might be employed in the destruction of some other insects. As these beetles do not appear till the latter part of July, or first of August, early potatoes will suffer less from their attacks than later varieties.

Another blister beetle, *Lytta Cinerea*, *Fabr*, that sometimes attacks potatoes, is also found in Vermont. It is about one-half inch long, of ash gray color over the upper part of the body, while the antennæ and legs are black. The whole insect is really black, the gray appearance being due to a light down which may be rubbed off leaving a pure black surface. It appears the last of June and attacks the leaves of the bean, honey locust, apple, the young fruit of the latter, and the leaves of the potato. Harris says that it is more troublesome than any other blister beetle in Massachusetts, sometimes appearing in large numbers, but I do not know that it has done great damage in Vermont. They are not often seen during the hottest parts of the day, as they feed usually in the morning and evening, burrowing in the earth the rest of the time. They lay their eggs early in August in the ground where they hatch in about four weeks into slender grubs, of a yellow color, with dark or black stripes and reddish heads.

Another of the blister beetles found in Vermont is *Lytta atrata*, *Fabr.* It is about the size of the preceding, being about one-half inch long. It is jet black. It occurs on *Solidago altissima* and other species of the golden-rod, and sometimes appears in considerable numbers in potato fields where it eats the leaves of the plants. On account of the fondness of this beetle for golden-rod, it is very unwise to allow that plant to grow near a potato field. Indeed a hedge of this or any other weed about cultivated fields is capable of great damage, for, aside from the slovenly appearance of such a growth and the certainty that hosts of seeds will be scattered where they are not wanted, there is the additional inconvenience that it affords shelter for many injurious insects. Many of our most injurious species can live comfortably, at least for a time, upon different species of wild plants, and some feed upon either wild or cultivated plants as may be most convenient and pass readily from one to the other.

Another and larger beetle is *Lytta marginata*, *Fabr.* It is nearly three-fourths of an inch long. The head and thorax are covered with gray down, while the wing covers are black with a narrow margin of gray; the under side of the body and the legs are gray. It lives on the *Clematis*

Virginiana most commonly, but it also feeds upon the leaves of several species of *Ranunculus*, but it sometimes deserts these for potatoes, and commits no inconsiderable ravages.

There is another blister beetle of much more robust form than the preceding, of a bluish, metallic color. It has very small wings and a large abdomen, and looks somewhat like a large ant. This beetle, *Meloe angusticollis, Say.*, ordinarily feeds on buttercups, but sometimes attacks potatoes, though it has never, I believe, done much mischief. All of these beetles except the last may be destroyed by driving them into straw and burning them, or they may be brushed from the plants into a basin of water and when the wings are wet they cannot fly. A gauze net swept over the plants will capture many of them, and where the numbers are not great this method might be most convenient.

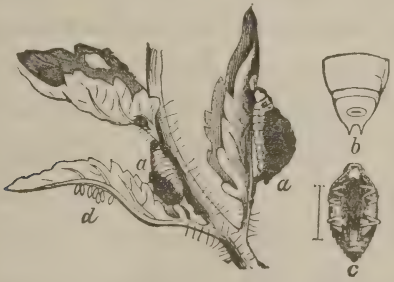
Figure two is an enlarged cut of a very small, agile beetle, *Haltica cucumeris, Harris*, that sometimes attacks potato leaves, and has occasionally done much damage.

CUCUMBE FLEA-BEETLE—HALTICA CUCUMERIS.—*Harris.*

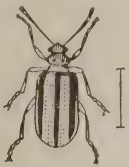
It is only about one-sixteenth of an inch long, black, with light yellow antennæ and legs. The upper surface of the body is covered with depressed dots. A somewhat similar species is found on the grape vine. Its hind thighs, which differ from the rest in being brown, are very large and fit the animal for leaping. It is found on quite a number of different plants, attacking the leaves and by riddling them causes them to wilt and die. The larva also feeds upon the leaves of many plants. Watering the leaves of infested plants with lime water, Paris green water, or similar compounds, will probably prevent the ravages of this insect.

There is a common beetle in this State which is sometimes mistaken for the striped potato beetle, or Colorado beetle. It is commonly called the three-lined leaf beetle, *Lema trilineata*, *Olliv.*, figures three and four. It is one-fourth of an inch long, of a yellowish color, with two black dots on the thorax, and three black lines along the back. It is about one-eighth of an inch broad.

FIG. 3.



THREE-LINED LEAF BEETLE—LEMA TRILINEATA, *Olliv.*
a, larva with coating of excrement; b, end of abdomen (seen from above showing position of vent; c, pupa; d, eggs.

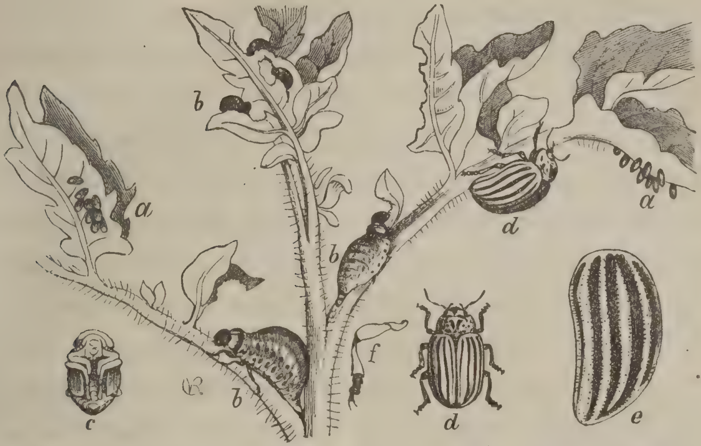


THREE-LINED LEAF BEETLE—PERFECT INSECT.

This insect, in both larval and adult state, feeds upon the leaves of the potato. The eggs (figure 3, d,) are laid in yellow clusters upon the leaves. In about two weeks they hatch into grubs of a dirty yellow, or whitish color, (figure 3, a,) with dark heads and two dark dots on the first ring back of the head. They have a singular and filthy mode of concealing themselves. The vent is placed on the top of the last ring and after stuffing themselves with leaves the dung falls in abundance upon the back of the larva and is gradually pushed forward towards the head until a mass accumulates sufficient to cover the whole back with a greenish pulp. This serves to protect the soft and tender body of the larva from the sun and especially from the observation of its enemies. When the covering becomes dry the larva shakes it off and a new one takes its place. In about two weeks after the larvæ come from the egg they leave the potato, descend to the ground and form a cell of earth in which they change to chrysalids, in which condition they remain for about two weeks, and then they emerge as perfect beetles and climb up the potato stalk and anew devour the leaves and lay their eggs. Thus there are two broods of this insect each year. The only remedies seem to be hand picking, or Paris green, and there is no reason why the latter remedy might not be as efficacious against this pest as against the Colorado beetle.

We now come to the chiefest agent among insects in the destruction of the potato, the famous ten-lined potato beetle (*Doryphora decemlineata*, *Say*).

FIG. 4.



TEN-LINED POTATO BEETLE—COLORADO POTATO BEETLE —DORYPHORA DECEMLINEATA.—*Say.*

a, a, eggs; b, b, larva of different ages; c, pupa; d, perfect insect; e, right wing cover; f, leg enlarged.

It might be taken for granted, in view of all that has been published about this distinguished depredator, that every one was already fully acquainted with its appearance, habits, and the remedies against its ravages, but I am not altogether certain that a somewhat full account of the insect will not be useful. I had specimens sent me last summer from the western border of the State, and it probably occurs in the southern border, at any rate it is not unknown in Massachusetts and there is very good reason to believe that during the coming season it will be found in more than a few places in the State. Should it occur even in considerable numbers as it may, though probably not, during 1876, it will not be nearly as destructive as a year or two hence if its increase is not effectually checked. It is to be remembered that we have every reason for believing that it will be much easier for the farmers of Vermont to check the progress and increase of this insect at the outset, than to fight it after it has become abundant. I am by no means certain that it will ever be able to do the damage to the Vermont potato crop that it has done farther West. The comparative shortness of our seasons, the severity of our winters, our wild lands and mountains, will all of them check its progress, but allowing these barriers their full weight, we still have abundant reason to fear that great damage may be done. It will be profitable for us to examine the progress of this insect from its first onset. It appears to have been known for fifty years in the mountains of Colorado where it feeds upon a sort of wild potato. It was confined to that locality until after the cultivated potato was brought near its native haunts in the progress of settlement of the country. Then, most unfortunately, it gradually acquired a taste for the cultivated potato and increased food favoring increased numbers in the beetles, they began to migrate eastward, devouring the potatoes as they went. Its progress as given in various reports is as follows: In 1859 it reached Nebraska, in 1861 the western limit of Iowa, and in three or four years crossed that State, going over the Mississippi River in 1864 and entering Illinois at five different points during that year. Riley states that the northern columns moved more rapidly than the southern. In about two years it had spread over the whole of Illinois, and in 1867 reached Indiana, crossing that State during the year, and entering Ohio in 1868. In 1871 it appeared in Western New York, and in 1874 in the eastern border of that State, as well as in Connecticut, Massachusetts, New Jersey, Delaware, Maryland, and Virginia, and in that same year reached the seaboard in several places according to Riley, but not until 1875 did I know of its appearance in Vermont in the southwestern part of the State and not till June, 1876, did it appear about Burlington. Thus its eastward march has been at a rate of from fifty to seventy miles a year. I should rather say its spread has been at that rate, for we do not find a moving mass of insects leaving one place and going to the next. Where they have once been there they are still. It seems to be only the surplus that extends eastward, and they diminish probably not so much because of migrations as because of the increase of natural enemies and of artificial means of destruction in the hands of farmers. This beetle, fig. 4, d, is, as many of you doubtless know, a short, thick beetle shaped like our common rose beetles, or lady-bugs. It is about one-half inch long and a little more than one-fourth of an inch broad when the wings are closed. Along the back are ten black lines on a yellow ground, and the thorax is yellow dotted with about eighteen black dots in rather a peculiar manner. The under side of the beetle and legs are black. It is a clumsy, sluggish insect though able to fly if need be. Riley says that in the latitude of St. Louis it has three broods a year, but these are not separated by any well-defined limits, for, as the female deposits eggs at any time, and as the eggs mature at different times, the insect may be found in all stages all through the summer. It goes into the ground in the fall and remains there (in the larval state) until spring, coming out in May or June. The females are very prolific, each one laying about one thousand eggs, which in four or five weeks become perfect beetles, so that in a single season the unchecked increase of a single pair might produce no less than two hundred and fifty million beetles, supposing half of each brood to be females. And where they flourish their numbers are beyond computation. I have known fields picked clean every other day all summer, and the number of bugs thus collected did not seem to diminish as the picking was repeated. The eggs of the beetle, fig. 4, a, a, are orange colored, oval bodies, about as large as the head of a large pin. They are glued in greater or less clusters to the under side of the leaves. The larva, fig. 4, b, b, is a short, thick grub of an orange color, with a double row of black spots along each side, and the first ring behind the head is edged behind with black, the rest being pale. There is what is known as the false potato bug, which very closely resembles the true, and has often been confounded with it, but it is a Southern species and will not be likely to ever occur in Vermont, so that we need not stop to point out the difference between the true and the false. As to precautions to be taken against what may be a great trouble, we may say that the first, most obvious and most efficient that can be taken is to destroy it utterly as soon as it makes its appearance, at whatever cost of time and labor may be necessary. However great may be the trouble of exterminating the insect at first, it is far less than it will be at any other time. The farmers on the Western and Southern borders of the State should be especially vigilant, for they stand as guard over the whole State. It is encouraging to know that the sad experience of Western farmers has resulted in the discovery of sure remedies against the pest, but they must be used promptly and thoroughly. A very good way in this State, should they appear in any such numbers as to make ordinary hand picking too laborious, would be to plant, with as little labor as possible, a small patch of early potatoes, and let them be planted thick, sown broadcast and ploughed in if you like. Upon such a patch the bugs will collect first, as they always attack early potatoes before they do the late ones, and here they can be conveniently fought. Let the crop from this piece go, give it up to the bugs and destroy them there. Then the later crop may be planted elsewhere. I do not doubt that this mode of dealing with the bugs would prove effectual anywhere where the bugs were not well established in great numbers. The more isolated potato fields are from each other, the more easily will the crop be saved. The variety of potato seems to make a good deal of difference.

In 1870 eighty-one varieties were planted at the Iowa Agricultural College, and the Peach Blow, Peerless, and Chili No. 2 were far less injured than any of the rest. Indeed the Peach Blow seems to be more distasteful to the various sorts of beetles than any other variety. The blister beetles will attack almost any other variety sooner than this. All are familiar with the fact that Paris green is used as a remedy for the attacks of the potato bugs. Without taking time to present facts or arguments on either side of the debated question as to the safety of using this substance, it is sufficient for me to say here that a careful investigation of the case convinces me that in careful hands it is entirely safe. If it be taken into the stomach it is surely poisonous, and, of course, if it is left where children can gain access to it accidents may happen, but it is not possible, I think, that potatoes can be rendered poisonous by its presence in the soil. It is always insoluble in pure water, and in water containing carbonic acid though soluble, it is immediately changed into an insoluble precipitate if any oxide of iron is present in the soil, as it very often is, and the same may be said of ammonia, and it seems quite impossible that it could in any way get into the substance of the potato. If much were applied and potatoes were full of worm-eaten cavities, some might be lodged in these, and such potatoes if carelessly washed and eaten outside and all might do mischief, but I cannot see how there is danger from any other source, and the fact that thousands of bushels of potatoes have already been eaten without injury in various parts of the country, coming from plants that had been freely sprinkled with Paris green, indicates that it does not affect the tuber. This substance may be applied dry, mixed with ten or twelve parts of flour, plaster or other like material, or it may be mixed with water, in the proportion of a tablespoonful of the pure Paris green to a pailful of water. As it only mixes with the water and does not dissolve in it, the liquid should be frequently shaken, and it may be sprinkled over the leaves.

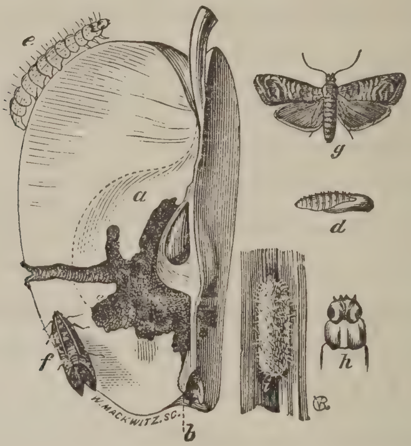
I have recently seen the statement that a whole family in Virginia had been severely poisoned by eating apples picked up under a tree near which potatoes that had been sprinkled with Paris green were growing. It should be obvious to any one that unwashed apples picked up from ground over which there could by any possibility be even the least sprinkling of Paris green, should not be eaten. The substance can be safely used if proper and constant care be taken, otherwise not.

The Colorado beetle has quite a number of insect parasites that attack it in various stages of its existence. Among these are several species of lady-bugs, four or five black bugs like our squash bug, as many beetles besides the lady-bugs including the striped blister beetle, a species of wasp and a few birds. In Iowa the Rose-breasted Grosbeak has been seen eating the striped potato beetles greedily, and as the insect spreads over the country its natural enemies seem to increase in number and efficacy.

INSECTS INJURIOUS TO THE APPLE.

The number of insects that infest apple trees is very large. I doubt if there be any other cultivated plant or tree attacked by so many. Some attack one part, some another, each species having its own peculiar mode and place of assault. Some injure the root, some the bark, others the wood, many eat the leaves, others the buds, others the flowers, others the fruit, and the wonder is that we can have any fruit from this tree at all.

FIG. 6.

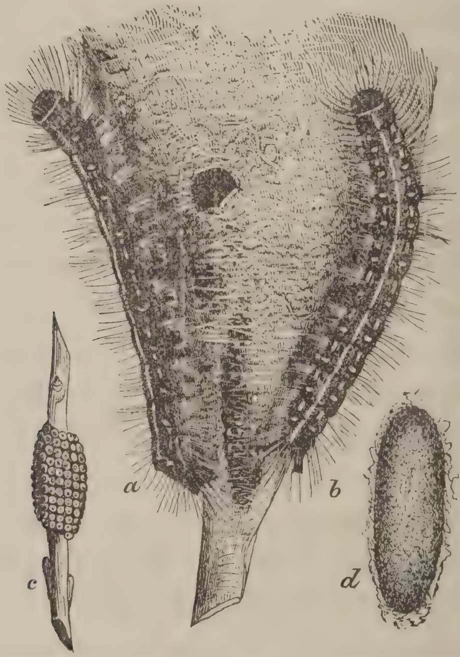


CODLING MOTH—CARPOCAPSA POMONELLA.—*Linn.*
a, apple eaten by larva; b, spot where egg is laid and the young worm enters; d, chrysalis; e, larva full grown, f, moth with wings folded; g, moth with wings expanded; h, head and first joint of larva (enlarged); i, cocoon.

Probably the most destructive of all this host in Vermont, if not everywhere else, is the codling moth, *Carpocapsa pomonella*, *Linn.* This moth appears to be widely distributed, being found wherever apples grow. It is an importation from Europe into this country, having arrived here probably not far from seventy-five years ago. It is a very beautiful moth when carefully examined. The wings (fig. 6, g,) are of grayish or brownish color crossed by fine lines of a darker shade. On the inner angle of the front wings is a large oval brown spot with reddish edges. The hind wings are light brown and lustrous. The head and thorax are gray and brown mixed, and the abdomen yellowish brown. The whole surface of the moth has a satin-like appearance. The wings are edged with a very delicate and pretty fringe of fine hairs. When fully expanded the wings are about three-fourths of an inch across. The sexes resemble each other very closely. The larva (fig. 6, e,) is about an inch long when fully grown. The head is black and the body is at first whitish, but as the larva grows its color becomes flesh-colored. On top of the first segment of the body is a dark colored plate. The body is covered with scattered hairs. The cocoons or shells which enclose the chrysalids, (fig. 6, i,) are covered with minute fragments of such substances as may be at hand. The moths lay the eggs in the spring, in the flower end of the fruit, (fig. 6, b,) and the worm eats into the fruit and develops within it. It reaches its full growth in a little more than a month. It then leaves the fruit and seeks for some crevice in which it may hide and entering this it changes into a chrysalis, in which state it remains about two weeks and then emerges a complete moth which lays its eggs and dies. These eggs hatch the same year, but the perfect stage is not reached until the following spring, usually about the last of May. This pest is not entirely confined to apple trees, but also infests pear, plum, crab apple, quince, and peach trees, though to a much more limited extent. Many remedies for the evil done by the codling moth have been suggested by one person or another. As the apples infested by the larvæ of this moth are usually ready to drop prematurely, a careful gathering and burning the windfalls or feeding them to hogs is beneficial. Jarring the trees will bring down more of these imperfect apples, and this may be repeated from time to time. The most efficacious remedy however is a bandage of some sort tied about the tree once or twice or even more. All rough bark and anything else that can afford shelter for the worms should be thoroughly removed, for the use of the bandage is to afford an attractive shelter to the worms as they leave the fruit and instinctively seek a hiding place in which to pass the chrysalis state, and they will take the best that offers, so that if the trap is to succeed, no rival shelter must remain near. The time at which the bandages should be kept about the trees will differ somewhat in different latitudes. They should be first placed about the trees just before the worms come from the young fruit, that is about a month after the trees are in bloom, which would be in this region early in June. It is useless to trouble about the bandages before this time. From the first of June until the fruit is picked, the bandages should be kept in order, being examined every week or ten days, and the chrysalids destroyed. During the latter part of the season they need less close watching. As to the material of the bandages it does not seem to make much difference what it is so far as the moths are concerned, several made of different materials being equally as efficient, but some are more convenient and economical than others. Old rags have been much used and are undoubtedly good. Hay bandages are also good and the material cheap, but less easily applied to the tree than some others. Riley recommends, as cheapest and best, bandages of common coarse straw paper, made by folding sheets loosely and fastening them with a tack about the tree. .These strips have proved very efficacious, are cheap, easily attached to the tree and easily burned. A more expensive, but very useful bandage might be made, as Riley says, by tacking strips of lath across a broad strip of canvas, and encircling the tree with it. Where a person has but few trees I think the best girdle would be a strip of canvas on the inside of which a layer of jute or hemp fibre was sewed. This could be fastened by a tack so that it could be easily removed and examined for chrysalids and the outside might be coated with tar so as to be a protection against the canker worm as well as codling moth. It is always to be remembered that the larvæ of the second brood are usually more or less abundant in the barrels or bins of stored fruit, and that from this source alone moths enough might come to stock the orchard the next season. On this account all barrels or bins as fast as emptied should be carefully examined and all chrysalids destroyed, and see that your neighbors do the same. The codling moth has quite a number of natural enemies such as ants, cockroaches, and other insects, as well as birds, and Riley has described two parasites, one of which attacks the cocoons and the other the moth just before or as it leaves the fruit.

Another of the Lepidoptera, the Bagworm, *Thyridopterix ephemeræ formis*, *Haw.*, sometimes attacks the leaves of apple trees in other States, but it is too much a Southern species to be found doing mischief here. But there is another moth, *Clisiocampa Americana*, *Harris*, that does live in Vermont, as well as in many other places, the larva of which is known as the tent caterpillar. Usually any extensive ravages of this insect indicate lack of care and watchfulness rather than anything else, and any one who can not succeed in keeping this pest away had better give up raising fruit, for there are many insects more difficult to contend with than this that will surely attack the trees. While if let alone these insects increase very rapidly, they can by a little labor be kept in check.

FIG. 7.

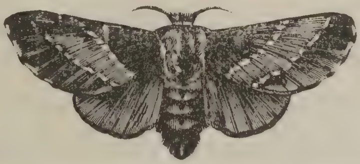


TENT CATERPILLAR OF APPLE TREES—CLISIOCAMPA AMERICANA, *Harris.*

a, larva full grown, side view; b, larva full grown, back view; c, cluster of eggs on a twig; d, cocoon.

The eggs (fig. 7, c,) are laid in clusters of from two to four hundred. This cluster forms a broad band about a twig and is covered with a waterproof varnish. They remain thus during the winter, hatching as soon as the weather becomes warm. As soon as the young larvæ come from the eggs they begin to spin threads of silk from the mouth, and begin to form a web. A large number of them live and work and eat together and the tent increases in size with the growth of the worms. They wander about the tree, eating its leaves, during the day and retire to the tent at night or in bad weather. The larva (fig. 7, a, b,) is about two inches long when full grown; its head is black, there is a light line along the back, and the sides are striped with dark lines on a yellow ground, and the body is covered with scattered hairs. They live in the larval state for five or six weeks, leaving the web or tent in the forenoon and returning to it, and again in the afternoon, for food. After they have reached their full growth they scatter over the tree seeking for hiding places where they may spin the cocoon and pass the chrysalis state, in which they remain for about three weeks, at the end of which they come forth as perfect moths.

FIG. 8.



TENT CATERPILLAR—CLISIOCAMPA AMERICANA, *Harris*, MOTH.

These (fig. 8,) are one and one-fourth to one and one-half inches across the expanded wings; they are of a reddish brown color with a broad transverse band of a lighter shade crossing the middle of each of the fore wings, on each side of which is a cream-colored line. Various efficacious remedies against the ravages of this moth are known.

The most common and poorest is burning the nests, but many usually escape the effects of this operation, and the tree is likely to be injured. If the nests are taken at the outset this method would be tolerably successful, but where the whole twig can be cut off it had better be done and burned. If the fruit grower is careful these nests will not appear, for he will go over the trees when the leaves are off and hunt up the egg clusters and remove and burn them. Strong soap suds, kerosene, or other such applications, in the nests would destroy most of the worms, but if the nest is the point of attack they must be assailed at the time when the worms are in them, that is during the night, or early in the morning. A few wild cherry trees near an orchard would be a great protection, as the moths lay their eggs on these in preference to apple trees, and they can be attacked on these trees and the apple trees go uninjured.

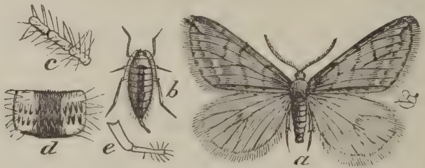
Another and similar species of tent caterpillar is extensively found in forests, and this sometimes visits orchards. There is a small, dark colored moth known as the bud moth which sometimes does much damage to the apple trees. This moth, *Penthina oculana*, *Har.*, is about one-half inch across the expanded wings, its head and thorax are dark ash color, as are the ends of the wings, but the middle of the wings is grayish, and there are two small eye-spots on each wing. The hind wings are dusky brown. The larvæ are pale brown, warty and somewhat downy, the head and upper side of the first wing being of a shining brown. They are found in May and June on the buds and young leaves of the apple trees devouring the leaves, or fastening them together. About the middle of June, or a little later, they become chrysalids and remain inside the curled up leaves in a web. Hand picking would appear to be the only remedy for this pest.

The larva of *Papilio Turnus*, *Linn.*, our largest species of butterfly, one of the swallow tailed group, sometimes injures apple, as well as other trees. The butterfly is yellow with black bands, especially about the middle and edges of the front wings. It is four or five inches across the wings when fully expanded. The caterpillar, or larva, lives upon the leaves of various trees, folding them up so as to form a sort of case, the edges being held together or near each other by a web. It is two inches or more long, green, with rows of blue dots, a yellow spot, with a large black center on each side of the third ring from the head, which is pinkish as is the under side of the body. It is found in July. I do not know that it has ever occurred in this State in sufficient numbers to do much damage. If it should hand picking would easily remove the chrysalids which hang on the trees from August until June.

There is a small caterpillar, known as the fall web worm, that sometimes attacks apple trees, devouring the upper part of the leaf. It is about one inch long when fully grown. Its color is greenish yellow, spotted with black, a broad, yellow stripe running down the back, and a yellow one on each side. The head and feet are black and the body is warty, and from the warts come bundles of soft hairs, and the moths of this species, *Hyphantria textor*, *Har.*, are white, one and one-fourth inches across the expanded wings. Another small caterpillar, of a yellow color, with bright red head, and with a conspicuous brush of hairs at each end, occasionally does much damage to apple trees, sometimes wholly preventing them from fruiting. This moth, *Orgyia leucostigma*, *Smith*, has wingless females; the males are of ash gray color, with wavy bands of a darker shade on the upper wings, which have a small black spot near the tip and a white crescent near the outer angle. The wings expand a little less than one and one-half inches. The female is lighter in color than the male. The eggs are laid on top of or near the cocoon and covered with a white substance which becomes brittle as it dries. This has more than once done some damage to apple trees in Massachusetts by eating the leaves, but it does not usually occur in sufficient nnmbers to do much harm. Picking off the eggs would be the remedy.

A great pest to our apple trees is the well known canker worm, *Anisopteryx vernata*, *Peck.*

FIG. 9.



CANKER WORM—ANISOPTERYX VERNATA, *Peck.*
a, male moth ; b, female moth ; c, joints of female antenna ; d, joints of female abdomen ; e, ovipositor ; a, and b, natural size ; c, d, and e, enlarged.

The males of this moth (fig. 9, a,) are very prettily and delicately formed. The wings are large, soft and silky, and quite thin. The front pair are dark gray, or ash colored, bearing a white spot on the anterior edge near the tip, and have two whitish bands, on the outside of which are black dots. The hind wings are of lighter color, with a dark dot near the middle. Both pairs are delicately fringed around the edges. When fully expanded they are one and one-fourth inches across. The female (fig. 9, b,) is a very different looking insect, having no wings and a large, bulky body, of a long-oval shape, covered with down. The upper surface is dark gray, the lower lighter gray. Across the abdomen in both sexes there are two lines of spines pointing backwards. The colors of the wings in the male are very variable,—they are always of a dusky shade but the lines and spots are often lacking, either partially or wholly. They are most active in the evening. The female is clumsy and sluggish in her movements. As the larvæ must have suitable food at hand as soon as they come from the eggs, if the female can be prevented from laying the eggs on the branches of trees the leaves of which the larvæ feed upon, the next brood may be destroyed. The female has a jointed ovipositor by means of which the eggs are placed under the scales of bark, or in the most convenient hiding place, often in the West using the empty cases, according to Riley, of one of the leaf crumplers, *Phycita nebulo*, *Walsh*, which does not occur, I think, in this State, but does considerable damage in the West. Riley says that the eggs number from fifty to a hundred and fifty. They are slightly glued together in clusters and hatch as the leaves begin to unfold. The larvæ are, when first hatched, dark green or brownish green. Along each side is a light band and one along the back and this latter has along its middle a dark line. The light stripes are broad. As the worm grows older and changes its skin it is of more uniform color, being brownish, and the head, at first black and shiny, is brown. When full grown it is about one inch long, of quite variable color, being sometimes light gray and all shades from that to nearly black, and the head is brown, mottled with black or dark brown. On the first joint back of the head there is a yellowish shield. There are six true legs in front and four false legs behind. The under side of the body is yellowish, or greenish. The ends of the body are somewhat darker than the middle, and there is a pale greenish band along the middle of the under side. "The chrysalis is light brownish, tinged on the wing sheaths with dark green." (*Riley.*) I have been particular in describing the canker worm in its various stages, because there are several similar insects of very different habits, and in dealing with this or them it is important that the farmer know just what insect he is fighting.

When the worm has reached its full size, it either creeps down the trunk of the tree or lets itself down by a silk thread, and, as it reaches the ground, burrows into it two or three inches, and forms a cocoon of bits of earth and silk threads, and remains in the chrysalis during the summer and winter, coming from it the following spring as a perfect moth, when the females crawl towards the first trees they find that are of suitable species, and ascend them, the pairing taking place during the ascent. They not only come from the cocoons in the spring, but to some extent in the fall, and in mild days even in mid-winter. Harris says that he has seen them in Massachusetts every month from October to March, and that there are more females than males among those that come out in the fall and winter, while the reverse is true of those that come out in the spring. In Vermont I do not think that many come from the cocoons in the fall, and very few if any come out during the winter; so that it is in spring only that we are to expect them in any numbers. They attack other trees beside the apple, such as the wild cherry and elm.

As to remedies, the following are more or less effectual, and all have been tried fully. I give them as the best that have come under my notice.

To prevent the passing of moths up the trees, tarred strips, troughs of oil, etc., are all effectual, if properly used. Le Baron recommends putting a band of rope or twisted hay around the tree, and over this a tin band four inches wide, so placed that the rope shall be in the middle of the band—i. e., put the rope two feet from the ground, or less, and fasten the ends with a shingle nail; then take a strip of tin four inches wide and long enough to go around the tree over the rope; let the ends of the tin lap, and nail through them and the rope to the tree, thus making a sloping band. This has been found to effectually prevent the ascent of the moths. If this is used, the moths will then lay their eggs below it, and, of course, the same remark applies to any band that keeps them down, and these must be destroyed by kerosene brushed over the trunk. If, however, these remedies have not been used, as they lay their eggs for the most part on the under side of the bark scales, on the trunk or larger branches, if the tree be thoroughly scraped and the scrapings burned the number of worms the following season will be greatly lessened. If the worms have hatched they can be removed from trees that are not too large by jarring them down and catching them in a net or otherwise, as they hang from the trees and burning them.

If the worms get into the ground, late ploughing will do much to expose them to destructive agents. Another protector is given in one of the Massachusetts Agricultural Reports. It consists of a trough made by taking grooved strips of plank and making a square trough of them around the tree, on the ground, the space between the trough and trunk of the tree is filled with earth, and the trough filled with coal tar from gas works. This is said to be a sufficient protection against the canker worm. In applying the bandages, troughs, or whatever may be used, it must be remembered that they should be in place early in the spring, so as to be ready as soon as the moths come from the ground, which is as soon as the frost is out of it, or even before. As has been noticed, in more Southern localities some of them come out in the fall and in mild weather all through the winter; but I should think that here, if the barriers were in place by the first of April or the last of March, they would be in time.

We need fuller observations than any that I know of as to the habits of the canker worm in Vermont. This moth has quite a number of insect foes, such as beetles, ichneumon flies, and the like, and a large number of birds, such as Chickadees, Thrushes, Warblers, Cat-bird, Cedar-bird, Bob-o-link, Oriole, Sparrows, Blackbirds, Woodpeckers, King-bird, etc., eat the larvæ and moths, and some, as the Chickadee, devour the eggs.

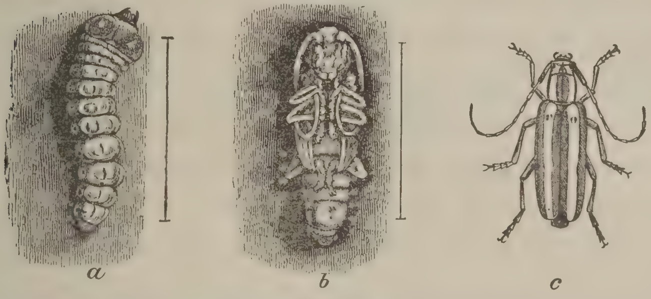
A similar canker worm is *Anisopterix pometaria, Harris*, which Dr. Packard thinks may be only a variety of the preceding. It is rather larger; the hind wings have a pale line across them; there are no lines of spines; it has no dusky marks on the front wings, no ovipositor in the female; the head of the larva is only faintly spotted, and when newly hatched is light greenish. In all of these characters it differs from the preceding and also differs in that the moths mostly leave the chrysalis in the fall. It is found mainly on the elm. Allied somewhat closely to the canker worm is a larger moth. The antennæ in this are not simple as in the canker worms but feathered. The female is more slender than that of the canker worm and has a grayish colored back, along which are two rows of black dots. The caterpillar is yellow, with ten black lines along the back, and is over an inch long. The moth is, in the male, of a brownish buff color, the front wings with two transverse wavy lines, one, that nearest the body, often being indistinct. The hind wings are lighter in shade than the front. The legs are buff and brown. It is one and three-fourths inches across the expanded wings. It has similar habits to the canker worms, feeds on the same trees, and may be checked by the same means. Its scientific name is *Hybernaria tilaria*, *Harris*. It feeds chiefly on the Basswood or Linden, Apple and Elm.

There are quite a number of species of Lepidoptera, the larvæ of which are called cut worms. Some of these do considerable damage to the buds of fruit trees, more in the West than East, but yet they should not be passed by in this paper. It is usual for larvæ of this sort to climb the trees during the night and drop from the buds on which they are feeding to the ground beneath at the approach of daylight to bury themselves in it. As they are not very good climbers they can only attack trees of inconsiderable height, but to the dwarf trees so commonly cultivated they may be very destructive. They do not like hard ground to work in and, as they fall from the tree, if they fall upon hard clay, or a stone, they are often destroyed, and putting clay about a tree and beating it smooth might prevent their ravages. Alkaline washes do not seem to affect them. If there is a pile of lime or ashes about a tree for them to hide in they like it very well. Cutting off the limbs nearest the ground would check, if it did not prevent their ravages. A tin trough placed about the tree is said to be effectual. They are very partial to loose, sandy soil, and trees or plants growing in such soil are especially liable to attacks from them. One described by Riley, under the name of *Agrotis scandens*, has done no little damage in Illinois. It seeks the buds of dwarf trees which it destroys. Another species, *Agrotis cochranii*, *Riley*, is also common West. This seeks first the buds of the flowers of fruit trees, and after these are destroyed, the leaf buds, doing great mischief. I do not know that either of these has appeared in New England, but we have an allied moth, *Noctua clandestina*, *Harris*. This does not climb high, but, if there are low branches, or the trees are small, it reaches the buds and ruins them. It attacks currants and other shrubs as well as many vegetables. The moth is grayish with faint, wavy bands and two small spots on the front wings, while the hind wings are brownish white. It is one and three-fourths inches across the expanded wings. The larva is a little over one inch long, of a dark gray color, becoming yellowish above and greenish on the belly. The head is black, with a white line in front. Quite a number of insects prey upon the cut worms and so help to keep them in check; birds, chickens, turkeys, &c., also prove a great help in their destruction. A very minute moth with long, slender wings, has proved destructive to apple trees in New York. It is called *Bucculatrix pomifoliella*, *Clem.* The larva feeds on the leaves of apple trees. It is about "one-half an inch long, of a dark green color, with the joints swollen so as to look like a series of beads, with a small head held horizontally, and with sparse, short hairs over the body. It has ten false and six true legs." (*Riley.*) The cocoon is "ribbed longitudinally," of a "dirty white" color. The moth is of the same dingy white color, or grayish with brown markings. It is only .12 inch long, and .3 inch across the expanded wings. The cocoons are grouped, it may be in large numbers, over the branches of trees, sometimes wholly covering small twigs. Riley says that kerosene or linseed oil washed over the infested branches will prevent this insect from doing damage. I do not know that this moth has ever appeared in Vermont, but I know of no reason why it should not be found here; and the fact that it occurs in an adjoining State should warn us to keep watch for indications of its presence.

The greatest enemies of our apple trees belong to the Lepidoptera, but there are some formidable foes among the Coleoptera or beetles. Among these insects the Curculios are only too old acquaintances of fruit raisers. One of these attacks the apple. It is a smaller insect than the plum curculio, with a much longer snout, which cannot be folded under the body so completely as that of the plum curculio.

This insect (*Anthonomus quadrigibbus*, *Say.*,) is from .05 inch to .08 inch long, of a rusty brown color, with three pale lines on the thorax, which, however, may be quite indistinct. It lives naturally on the wild apple, to which it is still confined in some places, and does not touch orchards which it may be quite near, while in other places it has acquired a taste for cultivated fruit, and commits extensive depredations upon it. There is one brood yearly. The eggs are laid in a groove cut out of the fruit, and the egg develops and the larva undergoes its transformations inside the fruit. As soon as the egg hatches the young worm starts for the center of the fruit, and feeds about the core. It reaches its full growth in about four weeks. It has no legs, cannot straighten itself, according to Riley, and could not, like the larva of other curculios, descend the tree. He tells us that when it has reached its full growth it "settles down in a neat cavity and assumes the pupa state." In this state it remains two or three weeks and then it becomes a perfect beetle. I do not know positively that this beetle is ever found in Vermont, but it is widely distributed over the country, and may very likely be in this State. It also attacks pears. Apples are also attacked sometimes by the true plum curculio. No very good remedy for this evil has yet been discovered. If all the infested fruit could be picked, or shaken off, of course the work of the beetle would stop, and the best thing that can now be recommended is to try to do this. Several species of boring beetles often injure apple and other fruit trees. It is only in the larval state that these insects injure the trees. The perfect insect is shaped much like the blistering beetles. One of the commonest of these, and one often occurring in this State, is a striped beetle *Saperda bivittata*, *Say*.

FIG. 10.



ROUND-HEADED APPLE-TREE BORER—SAPERDA BIVITTATA, *Say*.

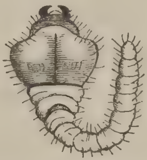
a, larva full grown; b, pupa; c, perfect beetle.

It is about three-fourths of an inch long, of a light brown color, with a broad white stripe running through the middle of each wing cover (fig. 10, c). The larva (fig. 10, a,) is about one inch long, light yellow, with a darker spot on the first joint, and a hard, smooth brown head, with black jaws. In this stage it is often called the round headed borer. The eggs are laid in June, near the base of the tree, and in about two weeks they hatch, and the young worms immediately begin to bore into the wood. According to Riley, it lives during the first year in the sap wood, in the fall coming down as near the ground as possible, and remaining torpid until spring; during the next year it works still in the sap wood, and is about half grown. Riley thinks that at this time it does most mischief, and that if there are four or five of them in one tree they will completely girdle it. During the next summer it works deeper towards the heart, and may work its way entirely through the tree, or, more often, it turns in another direction, after a time working back towards the bark and through it to the outside. It fills the end of the passage with dust and shreds of wood, and now, at the beginning of the third winter, it ceases to eat, and remains dormant till the next spring, when it becomes a pupa, and in about three weeks afterwards it changes to a perfect beetle. At first it is very feeble and soft, but in the course of two weeks more it grows strong, and the covering of the body becomes hard. As remedies against this insect, Riley recommends the use of alkaline washes applied to the lower part of the tree, and that all weeds and rubbish be kept away from the base of the tree. If the tree be well scraped and rubbed with soap, the borers will keep away. In the fall trees may be examined, and if borers are found in them, as may be known from their castings about the holes, they may be killed by pouring kerosene or hot water into the holes, or, better, they may be cut out, if they can be reached without too much damage to the tree.

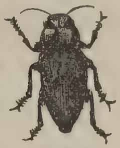
Another borer, known as the flat headed borer (*Chryso-*

bothris femorata, *Fabr.*), is the larva of a bronze beetle, of a greenish bronze above, and a reddish bronze below.

FIG. 11.



FLAT-HEADED APPLE-TREE BORER—CHRYSOBOTHRIS FEMORATA, *Fabr.*



LARVA OF CHRYSOBOTHRIS FEMORATA.

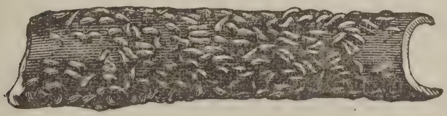
On the wings are two spots more decidedly bronze than the rest. It remains, according to Riley, but one year in the tree. It does not, in all localities, commit ravages that are worth noticing, but it sometimes occurs in such numbers as to do much damage. Besides the apple it is found in a variety of forest trees and in the peach, though it is not the borer most commonly found in peach trees. The same remedies as those named above would answer for this species. Several species of the Woodpeckers are exceedingly useful in destroying the various sorts of borers, and quite a number of insects prey upon them. Riley says that this borer, and the same is probably true of others, prefers partially decayed trees, and that a vigorous tree is not chosen by the female in which to lay the eggs if a sickly or decayed one is near by ; but yet it can live very comfortably in healthy trees, which, however, do not remain so long. He says that in a public park in St. Louis, a paint composed of soap, lime and a little Paris green, proved very effectual. This was brushed over the trunk. Riley, justly I think, recommends the use of soap or any alkaline wash, as preferable to scraping the bark, for the reason that if a tree is thoroughly scraped, the bark left is more or less scratched, and often these injured spots afford excellent places for the borer to deposit its eggs. It has sometimes been found that such places were well stocked with borers the next season. If scraping is done at all it had better be done very early in the season. Of course, a slight scraping, that removes only the loose scales of the bark, without in any way injuring the tree, is not harmful, and such a preparation of the tree for the soap or lime wash would be useful.

In the Mississippi Valley, a small beetle, *Amphicerus bicaudatus*, *Say.*, has done considerable mischief to apple trees, by boring into the twigs just above one of the buds, and after reaching the center of the twig it follows it for an inch or more. This beetle is of a brown color, a little less than one-tenth of an inch long. The surface of the wings and thorax is rough. The injured twigs perish. This pest has never been found in New England, so far as I know. The only remedy against such depredators is to cut off the infested branches as soon as discovered and burn them.

The roots of apple trees are attacked by several species of Aphis. Roots infested with these insects are very apt to rot, and may be thus destroyed until the tree perishes. One of these, *Eriosoma pyri*, *Fitch*, forms galls on the roots just below the surface. When young it is pinkish, like many other allied species, but as it grows older it is darker, more purple in color. The body is covered with a cotton like material. In the adult state it has transparent wings; the body is black, and about one-tenth of an inch long. This species seems to be more injurious in more Southern climates than that of Vermont, but though it may not here become, as it is said to be elsewhere, the worst enemy of the apple, yet it may do enough damage to require attention. Dr. Harris recommends as remedies soap suds, tobacco water, or hot water alone. Of course, the roots must be uncovered to receive full benefit from these substances. Allied species infest the bark of the apple tree. One of these, *Aspidiotus Harrissii*, *Walsh*, is found in Illinois and adjacent States. It forms scales, covering the branches. These scales are of a whitish color. It has many insect enemies, and does not do great damage.

Another species, *Aspidiotus conchiformis* of Riley's first reports and other works, but which Riley has found to be a new species and named *Mytilaspis pomicorticis*, is of wider distribution, and does far more damage.

FIG. 12.



BARK LOUSE—ASPIDIOTUS CONCHIFORMIS, *Gme.*

It extends from the Eastern border of New England West of the Mississippi River. It forms long, narrow scales, which are somewhat arcuate, and are much broader at one end than at the other, being shaped much like the salt water mussel, though popularly known as oystershell bark lice. The scales are of different colors at different ages, being yellow when quite young, and growing gradually darker until it is about the color of the bark on which it is fixed. Under each scale, according to Riley, there are from thirty to one hundred eggs of a "snow white" color. The larva is very small, oval in outline, of a "pale yellow, with a darker yellow spot near each end." The adult males are of a grayish color, the body .02 inch long, with transparent wings; the female is of a lighter color, being light yellow, length of body about one-twentieth inch. A very full description of the various forms of this insect is given in Riley's 5th Report. It seems to be a Northern insect rather than Southern, but where it occurs in the South it is two brooded. North of the Gulf States it hatches but one brood annually. There are several different species of insects that prey upon these bark lice. The young are hatched early in June, and run over the twigs, looking like white specks. In a few days the females become fixed, and after a time each is covered with a scale. In somewhat more than two months after hatching the insects are ready to lay their eggs. As remedies various authors recommend scrubbing the branches with sal soda water, though other alkaline washes than this do not seem to be very efficient. From my own experience with allied insects I should think that kerosene would be a very excellent remedy, but it needs to be carefully used or it will injure the buds. Carbolic acid and water, or suds made with carbolic soap, would be useful as a wash. It must be remembered that the larvæ are running about for only three or four days in the spring, and can only be attacked with much certainty of success at that time. Every purchaser of trees should carefully examine each one before, or immediately after setting out, and if scales or other signs of insects are found, they should be removed. Riley says that linseed oil has been found useful, applied after the twigs had been scraped, or on the scales, hot lye, he says, has also been successfully used. Many washes that are used injure the foliage, but only temporarily, the destroyed buds or leaves being fully replaced in due time. A similar scale insect attacks the pine, doing often considerable damage.

ADVANCE IN LABOR SAVING MACHINERY OF THE FARM.

BY C. HORACE HUBBARD, OF SPRINGFIELD.

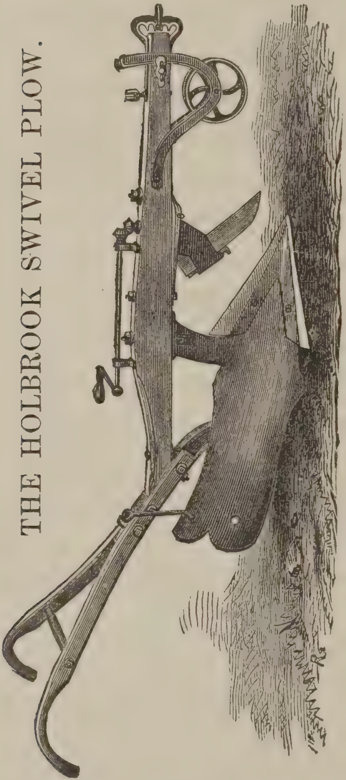
In an age characterized by a remarkable degree of progress in the mechanic arts; when the genius of man has subdued the forces of nature and made them subservient to his will; when, by the use of improved machinery in the useful arts, the productive power of man is multiplied a hundred or even a thousand fold; when manufacturers are eagerly seeking for new machinery which, at the same time that it effects a saving of labor, enhances the value of the product through its greater uniformity and exactness, the farmer is confronted by a necessity as imperative as the law of self preservation or self defence, to adopt every valid improvement in farm implements and machinery which will save manual labor and tend to make his farm operations independent and self sustaining.

It is an occasion for congratulation that the needs of agriculture have engaged the attention of modern inventors. Their efforts in behalf of farmers have borne rich fruit. To them farmers owe a debt which money alone can never repay. A hearty acknowledgment of the supreme value of their labors is due to the men who have given us so much. Its sincerity should be made certain by the acceptance and use of such of the labor saving machines they have devised, as are suited to our farms, our systems of farming, and our circumstances. By consulting our own interests we shall best reciprocate the benefits they have conferred upon us.

And yet, is it not true that there exists among farmers, more than any other class, an unwillingness to change, a reluctance to depart from the old way, "the good old way," and to use means and methods more in harmony with the intelligence of the age? Without pausing for a reply to this question, or to consider why it is so, if it is, I propose to consider very briefly *some* of the improvements which constitute an advance in labor saving farm implements and machinery. The first implement which needed improvement, and which had waited for it longest, was

THE PLOW.

When I remember the champion plow of the homestead, on which my own first boyish lessons were taken behind a "six cattle team," in a stony field, a plow that left the inverted sod as hard and firm as before it was lifted from its bed, going round and round, leaving dead furrows and ridges, and the furrows at the corners compressed by the hoofs of the team in turning, I am free to admit that the modern swivel plow is a wonderful saver of labor for the harrow and the hoe, besides giving an increase of the crop. The perfect plow turns the furrows all one way. It permits the team to turn on the unplowed land, and leaves the headlands to be turned last. These are not, however, its most valuable characteristics. While it is so constructed as to take land properly and hold easily, its form is such as to invert the sod properly, and leave it in the best condition for preparation for the seed. Soils require varied treatment according to their texture and other characteristics, and it is undoubtedly true that no plow in existence is the best for all soils. At the same time it is true that few fields have a soil so light and friable that the condition in which the plow leaves the well turned sod is a matter of indifference. One of the most intelligent and successful farmers in the State says that the saving of labor in harrowing (twelve or fifteen acres of alluvial meadow,) pays him every year the whole cost of one of the high priced modern swivel plows. A plow with a mould-board so formed that as it lifts the furrows it disintegrates and granulates the whole substance of the sod, so that the roots of growing plants can penetrate it in search of the food they require, is the nearest approach to the perfect plow.



THE HOLBROOK SWIVEL PLOW.

Next in the natural order of succession comes

THE HARROW.

The feet of the harrowing team beat down the furrows and compress the soil. It is important that the harrow should tend to lift the soil and make it lighter, and with dispatch. The straight toothed harrow scratches and mellows the surface, but it hardens that below. A share or coulter which works under the soil, or a revolving disc or plate which cuts and crowds it to one side, are either of them a great advance in the right direction.

PLANTERS

For corn and potatoes, the former for either one or two rows, one or both ways and in drills; the latter cutting as well as dropping and covering the seed and fertilizers, are now so well perfected that their operation is reliable and satisfactory, and their use on hill farms as well as meadows advisable, and a great saving of labor.

The corn harvest may now be greatly accelerated by the use of the

CORN HUSKER,

Driven by horse power. Doubting farmers, who never saw such a machine in operation, and who believe nothing in regard to their own calling which they have not seen with their own eyes, do not believe that a machine driven by a pair of horses, and managed by three men, can take corn as a thresher takes grain, and turn out forty or fifty bushels of clean, bright ears of corn an hour. And yet machinery performs feats far more difficult. One who has witnessed the work of a fast printing press, as it turns off copies of a large daily paper, is prepared to believe that *anything* can be done by machinery.

SEEDERS.

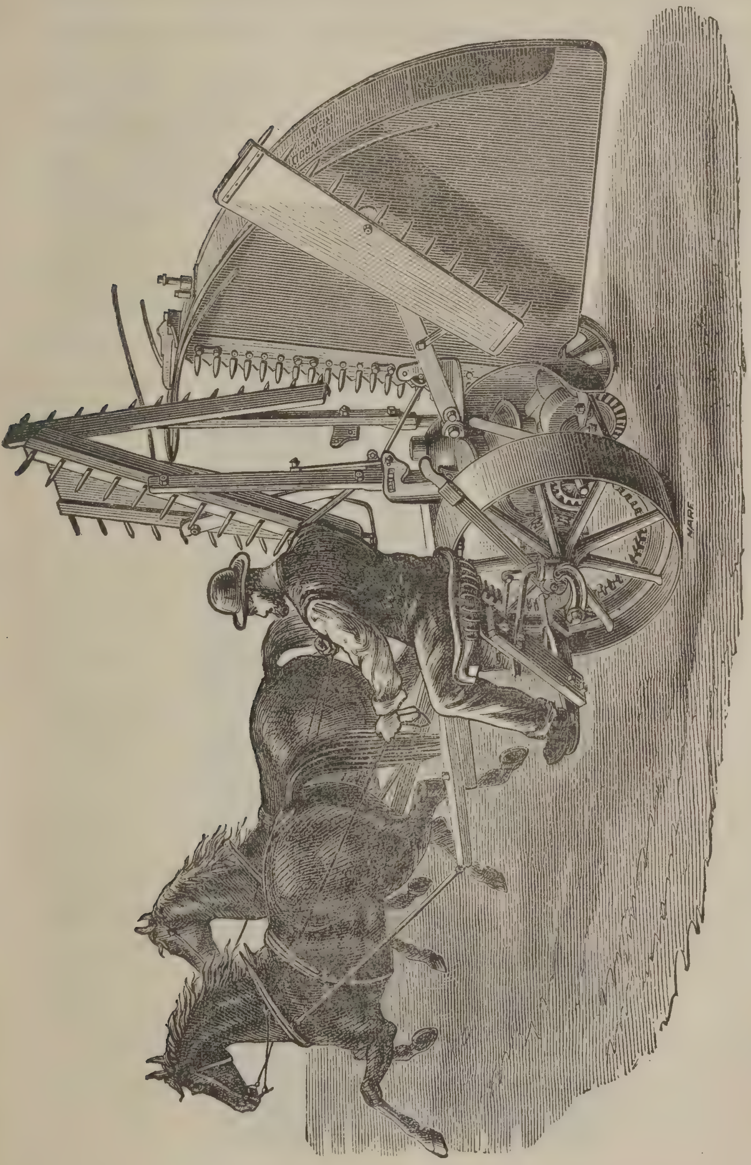
For small grain, broadcast seeders or drills not only save labor, but give an even seeding and uniform depth of covering. Sowing grain by hand requires skill and pains-taking, and good judgment, and is very laborious. A boy with a pair of horses and seeder, can, as he rides, sow double the area that the man can do by hand; and he sows it better and covers it as he goes. The saving of labor and gain in the quality of work soon pays the interest on first cost and depreciation.

In the grain harvest the farmers of Vermont are slow to follow the example of their Western brethren in using

THE REAPER.

The sweep-rake reaper is now so perfect a machine that it will reap grain so badly lodged that it is with difficulty that it can be mown with a scythe. Grain beaten flat on the ground, leaning in any and every direction, is picked up and laid in bundles ready for the binder. Nor is this all. The self binder, a more expensive machine, reaps the grain and binds it. A man or boy of ordinary intelligence, with a pair of horses, reaps and binds twelve acres a day with ease. If farmers will avail themselves of the use of machinery, who shall say that we cannot raise grain in Vermont?

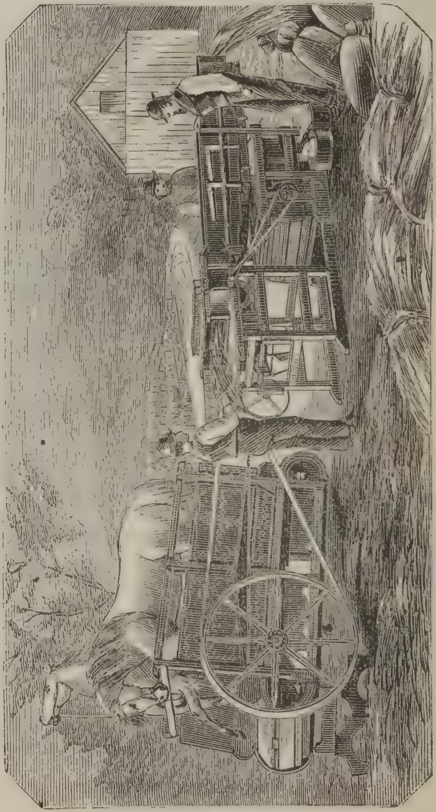
WOOD'S SWEEP RAKE REAPER.



HORSE POWER

On the farm is too rare. Farmers depend upon itinerant machines for threshing, with all the attendant extortion and inconvenience. With a power, thresher and saw, owned on the farm, or jointly by two or three neighbors, their use is much more economical and satisfactory, and may be extended to the cutting of fodder, grinding grain, turning grindstone, churning, etc.

GRAY'S HORSE POWER AND THRESHER.



Of haying machinery nothing need be said urging the use of

MOWERS.

They are admitted a necessity by the most conservative. The mower was the pioneer labor saving machine on the farm. Its utility and value were doubted at first. The prejudice against it was fortunately overcome before the strong young men of the farms were called away to a harvest of blood in defence of our country, else the grass crop must have rotted in our fields.

There is another machine of equal value, though not equally indispensable in the hay field,

THE HAY TEDDER.

Grass will cure in time lying on the ground. But its quality is often greatly impaired by unnecessary exposure to the sun, dews and rains. The injury by over drying hay is far greater than is commonly supposed. Heavy crops of grass, if cut early, must be agitated a great deal, else the surface is burned dry and hard before it is all cured. The constant use of the tedder keeps a heavy body of freshly mown grass so light that it cures with surprising rapidity. The improved quality of hay soon pays the cost of a tedder. Besides, it saves one day of risk, often more, to storms, and does the work of eight men, doing it better than they can (or will,) do it.

Improvements in farm machinery are no more conspicuous than in

THE HORSE RAKE.

Any man who ever held the old Kimball Rake, usually called the "man killer," or "scratch rake," will admit the truth of the foregoing remark. The perfect modern sulky rake has long teeth, that slide along through the stubble without scratching the ground. Its head or rocker-shaft is so hung that its weight balances the weight of the teeth. A combination of nicely adjusted levers, (with a draft rod to the whiffletree,) enables a boy, by a slight pressure of the foot, to dump the hay. Others have gearing on the wheels, friction bars, and hand or foot levers.

A relative of the writer, whose little son, seven and one-half years old, raked all the hay, and raked after the cart over eighty acres of meadow, entertained the opinion that sulky rakes are an improvement.

Inventors have not been idle in producing labor saving

DAIRY IMPLEMENTS.

The system of associated dairying, with its numerous modern implements, has lifted a cruel burden of toil from the shoulders of overworked farmers' wives and daughters.

In the butter dairy, as managed at home, the habit of setting milk in large pans effects a great saving of labor in lifting milk and washing pans. The questions of deep or shallow setting, and cooling, are in such a chaotic state that we do not know as yet what to accept.

It may not be out of place to say a word in defence of manufacturers' prices. While it is true that many machines retail at a large advance from first cost, it must be remembered that competition is so sharp that to secure anything beyond a local market, large sums must be expended in advertising, printing, agents' commissions, and exhibitions at fairs. And, as a matter of fact, the net profits in but few cases do more than keep the manufacturers out of bankruptcy.

If farmers would only canvass without prejudice this question of buying for themselves all such labor saving machines as they can afford, joining with neighbors in ownership and use when necessary, there can be no question that the result would be an economy of labor, better cultivation of the soil, and more abundant crops. Their material condition would be improved. The lightening of the labors of the farm would remove one of the hindrances to retaining the young men in the pursuit. The increased profitableness would offer new attractions to them and the young women who are to walk and work with them. Some portion of the time gained could be devoted to study, recreation and travel, so much needed by us all. The dignity and respectability of our calling would be enhanced. Then, as agriculture is lifted to a higher plane, as we become more noble as farmers, as citizens, and as men, we could exclaim in spirit and in truth, there is really an advance in farming machinery, in farming, and in farmers.

THE GRASS CROP.

BY C. HORACE HUBBARD, OF SPRINGFIELD.

(These remarks were given extempore, the following being an abstract.)

Of all the productions of Vermont farms the grass crop is the most important and valuable, because without it other crops cannot well be produced. A good crop of grass is the basis of success in farming. With abundant crops of grass, all other crops are possible, for there will be a plentiful supply of genuine fertilizers. When the soil of farms is so exhausted that the grass is light, all other crops are raised at a disadvantage. Abundant crops cannot be raised from an impoverished soil. The farmer who would make his business remunerative, must maintain a general condition of fertility and productiveness in his fields. There is, apparently, a basis of truth for the complaint that "Vermont farms are running down"; do not raise as much grain, or carry as much stock as formerly. The fact is a discouraging one to those who own such farms. It is not creditable to the agriculture of the State. How to restore the fertility of those farms, make them blossom again in plenty, and return a quick and generous response to the labor of the husbandman, is a problem worthy of the most serious consideration.

It must be borne in mind that men upon "run-down farms" have usually no means to purchase fertilizers of any kind, and little faith in their value. Neither can they see their way clear to augment the manure heap by the use of purchased food. The restoration of the soil must be from its own resources. And they afford us the most substantial and reliable basis upon which to build. Nature never cheats us.

The cheapest, most certain and satisfactory way for farmers in the situation of those described to bring up their farms, is to make a specialty of the grass crop, or, at least, to give special attention to its culture. In some cases it may be best to discontinue for a time the raising of grain. In others the area in grain may be reduced. It is as certain as anything can be, that a system of grain raising which requires twelve or fifteen years to go the rounds of the mowings, keeping half of them waiting half a dozen years after they are "run out" for manuring and re-seeding, will never increase the crops of a farm, but will reduce them year by year.

Now we will suppose that a farmer has sixty acres of mowing. His average hay crop only yields manure enough to fit four acres a year for planting, these four acres to be sown with small grain and seeded to grass the next season. It requires fifteen years for this rotation to take in all of his sixty acres, and thirty acres of it cut light grass every year. In unfavorable seasons the area of light grass is larger still. This farmer is sure to complain of the "hard times." There is one grand principle of which he and all farmers may take advantage. It is this: Grass is a spontaneous product of the soil; it requires little manure, and, if cut before the seed forms, is but slightly exhausting to the soil. The farmer may, then, contract the four acres of planting to three acres. The manure that would have been used on the fourth acre will be enough to fertilize three acres sufficiently for grass. If only two acres are planted, six acres besides may be re-seeded to grass or top-dressed. It is readily seen what a different degree of progress is made in going over the old mowings, nine acres being re-stocked every year instead of four. Every additional acre that is made to yield a large crop of grass increases next year's manure heap. I do not desire to be understood as discouraging the raising of grain. Many farmers find it to their advantage to raise much grain every year. But to other farmers it is simply suicidal.

There is a prevailing misapprehension as to the needs of the grass crop in respect to the time and manner of sowing, it being supposed that grass seed sown in spring must have grain to shade it, and that it will not do to sow it late in the fall. Grass seed may be sown with good results at any season of the year when the soil is in suitable condition for working. I have sown grass seed from early spring up to November, getting two good crops the next season from seed sown in that month. If very dry weather comes on after the seed germinates, it is likely to perish, whatever the season, or whether sown alone or with grain. The farmer must take the risk of weather, whether the seed is sown in spring, summer or autumn. Spring sown grass will endure drouth quite as well without the shade afforded by grain as with it.

The soil where grass seed is to be sown should be mellow and fine. If the sod is decayed and mixed with the substance of the soil, a better catch and more lasting sod is secured. For this reason it is a good plan to plow sod land, allow it to lie several weeks, or months, as may be necessary for the decay of the sod, and re-plow it before seeding. Fertilizers should be fine and well mixed with the soil. Hard lumps of barnyard manure are of little value as a fertilizer for grass. Seed should be covered lightly with a harrow, a bush or a roller.

Clover seed may be sown early in spring, on fall seeded land. But it must be sown before the soil has become dry on the surface. It is better put on before the frost is out. There is, however, no doubt that clover seed is more certain to come if covered with the soil. Clover should always be sown as well as grass seed. Clover derives much of its nourishment from the atmosphere, and leaves the soil in fine condition for the development and growth of the grasses. Plaster is the cheapest fertilizer for clover. It should be sown when the young plants have put forth their leaves, and should be repeated annually, if not twice a year, as long as there is clover.

Lands planted with corn may be seeded to grass without grain with good results. The sod lasts longer than if the manure had been taken by a crop of small grain.

Lands that are rough and difficult of cultivation may be top-dressed. If there is a good sod, the benefits of top-dressing are greater than if the sod is poor. For this reason top-dressing should be frequent, and not be delayed until the grass is bound out, and its roots enfeebled or dead. Moist land shows better results than dry land from this manner of using manure. Its effects are far more apparent and beneficial in a moist season than in a dry one. Manure for top-dressing should be as fine as it can be made, and be spread evenly. If applied just before a rain, it shows its work quicker than otherwise.

When the farmer has brought every acre of his land into the production of heavy grass, he will have plenty of manure for raising grain.

One of the strongest arguments in favor of the grass crop is the small amount of manual labor necessary for its cultivation and harvest.

There can be no doubt that all the mowing lands of Vermont can easily be made to yield an average crop of two tons of cured hay to the acre. A majority of them could be made to exceed that quantity.

If farmers would only do this, it would place the vocation of the farmer in such a different and improved aspect that it would become the most popular business in the State, and our young men would turn their faces to the farm for their life employment as spontaneously as they now turn away from it.

I do not ask men to take my word for it, but to try the experiment for themselves. Do it fairly and thoroughly, and the result will be satisfactory.

WORK AND WAGES.

BY SILAS HOPKINS, OF EAST BERKSHIRE.

This subject was given me to write upon for the benefit of the Trout River Farmers' Club. It is an important one, however, to all the farmers in the State. It is an important one to everybody who works for pay or pays for work.

I cannot do the subject justice, but having worked for others for pay, and paid others for work; having seen upon farms all sorts of help; employed good help and poor, cheap help and dear (and generally found the cheap help the dearest), I may be able to make a few practical suggestions, hoping that this paper and the discussion which shall follow it may be useful.

I shall not undertake to tell you how much you ought to pay for chopping a cord of wood, or digging a rod of ditch, or what shall be the price of a month's work in haying, but shall consider briefly the mutual relation, and the mutual obligation of master and servant, employer and employed.

It is not possible to fix a uniform rate of wages. Sometimes a day's work will cost seventy-five cents, and then again, at another time, the same amount of work will cost a dollar and a half, or twice as much. At one time a dollar will pay for chopping two cords of wood, and at another only one. Work, like every thing else offered in market, is worth what it will sell for; and, like other things, is materially affected by the supply and demand. I have noticed this fact, however, about the price of work, it is about the last thing to go up, and the last thing to go down. The price of work will find its level, though not as quickly as other things.

It is not wise, it is foolish and worse, for the man who *works* to imagine he has a quarrel with the man who *pays* for work. *Work* and *wages* have a mutual interest. They are dependent upon each other. The large farmer must hire or lose money, and the poor laborer must work for pay, or beg, or starve.

This is a free country, perhaps you have heard. The man with money will not long pay a dollar and a half for work that is worth to him only a dollar. Neither can the laborer be *compelled* to work for less than he chooses to take. Such being the case, there must be a mutual agreement between employer and employed. Work and wages must come to an understanding often.

Work is like other things in this, too: The best is the cheapest. I have to pay John $1.50 per day for common farm work, and he is the cheapest help I ever hired. He does a lot of work and does it well. He will neither lie idle himself nor suffer others at work on the same job to do so. His judgment is good. If there is any best or cheapest way to do a thing, John will find it out. While the other fellow, who breaks tools, is always late to begin, slow to start, for-gets to shut the gate, makes us all wait for him, and abuses the team, is dear help at any price.

In speaking of the mutual obligations of the hired laborer and his employer, we shall first consider the obligations of the laborer, and afterwards the obligations of the employer.

There are some things that are expected of a good, honest workman.

First. He must keep his engagements. The man who is always behind his promises probably *knows* he is promising more work than he can do. I have known men—men of good standing in society, too,—to promise to do a job by such a time, when they well knew they could not do the job, and all the other work promised, by the time agreed upon. The promise was made, not to let the man know when his work would be commenced and finished, but for the purpose of securing the job, which in English is called a poor promise. The laborer must go to work when he agrees to; that is his first obligation to his employer.

Secondly. The laborer must give an honest day's work. It is not right for him to go into his own garden and work an hour in the morning and then again at night, thus taking from the day's work some strength and time which ought to have been used for the benefit of his employer. When a man hires out by the month or day, he usually asks, and his employer agrees to pay all the man can earn. He is under obligations, therefore, to do all he can for his employer.

Thirdly. A good laborer will always use his best judgment for the advancement of every legitimate interest of his employer. My trade, when not a farmer, is that of a stone mason. It has been my delight to honor one of my fellow masons. He was poor. I could honor him, notwithstanding. He hadn't the nicest sense of honesty, yet I would honor him; for, although he would sometimes make a bigger bill for time than he ought, he would put a lot of honest work into a wall, where no one but he and I ever saw it. He would put all his nerve, and he was full of energy; all his strength, and he was very muscular; and all he knew, and none knew better than he how to make a good wall, into a day's work. He was just a good model of a hired man.

Fourthly. The hired man must be obedient and strictly trustworthy. How important is this in the care of teams and other domestic animals. I once hired a ten or twelve years old boy, for three dollars a month, for eight months. He could tell me any time where I could find every tool on the farm. He could always tell me where my cap and mittens were; that was worth a good deal to me. If he told me the gates were shut and the bars all up, cattle fed, and chores all done, I took his word for it, for whatever he said was true. He afterwards went to work for the man who let his hired men eat their dinner without asking them how much work they had done that forenoon, and stayed there four years. His employer said of him: "The cattle all like Francis."

Fifthly. It is very desirable that our hired help should be intelligent and skillful workers. The opinion too generally prevails that almost any numhead will do for a farm laborer. I am glad so much has been, and is being said and written about brain work upon the farm. Who doubts that something ought to be done to elevate the standard of intelligence, and morality, too, of the farm laborers? And it is no consolation to us farmers, either, that the mechanics, professional men, men of commerce and trade, and the men in office and places of trust, are as much in need of Sabbath school instruction as the men who work on farms. If the farm hand does his work well and behaves well, why isn't he deserving of as much consideration and honor as the man who sells dry goods or groceries? or the man who dextrously uses the forceps or lancet? If a man's work is coarse and heavy, he may yet be very expert at it. Men may be, and sometimes are very clumsy at fine work which they claim to understand. We sometimes hear about skilled and unskilled labor, and we hear about experts in arts, sciences and the trades. Now what is the reason we haven't expert choppers, and reapers, and mowers? I will not take time to use any arguments to convince you that it requires as much skill to swing an ax at arm's length, and with full strength, so that the blows shall come within a hair's breadth of the point aimed at, as it does to keep on the right side of the line between a successful and disastrous surgical operation. But I wish to say that among the men of my acquaintance who can chop four cords of wood in a day and follow it, there are no fools. They are not only men of well trained muscle, but they are also bright men. I believe, in all kinds of farm work where strength is required, it is better to have men who can apply their strength intelligently.

Take a man of intelligence and good health, who weighs about one hundred and seventy pounds, and who has had no experience at farm labor. Set him to mowing, in the morning, where there are two tons of hay to the acre, with a scythe which he has selected, hung, ground, and must keep sharp himself; and before noon you can convince him easily, not only that knowledge is power, but that well trained muscle is essential to success in mowing.

The hired girl who knows how to make good butter, knows more than she can tell in an hour, and more than a beginner can learn in a year. In thinking it over, sometimes, I am surprised to notice how many kinds of work a good farm hand can do, and do well. He may not know much about books, but he has acquired a large amount of practical knowledge. He can plow, sow and reap, rake and pitch, use skillfully the ax, spade or flail, or drive oxen or horses. He knows how to raise all sorts of crops, from sugar to potatoes; knows the times and seasons for all sorts of farm work; and can give you good reasons why you should or should not keep a particular breed of cattle, horses, sheep or hogs on your farm; besides many things outside of his special calling. It is the duty of all farmers, as well as other laborers, to inform themselves about every thing that pertains to their work, so that they may not only be intelligent, but skillful workers.

If the obligations of employer and employed are mutual, and that they are I presume no one doubts, then let us consider now some of the obligations or duties which the employer owes to his hired help. I have said that the hired man must do the best he can for his employer. The employer is also under certain obligations to the laborer, of which the first I will mention is this: He ought to treat his hired man respectfully. If you are troubled with hired men you cannot respect, don't be forever telling over their failings and nursing your dislike. Better discharge them and hire men you *can* treat well. I know two or three boss mechanics who are in the habit of hiring ignorant, cheap, inefficient fellows, and then perpetually yelling at them, and deriding them for their stupidity. For such trouble the remedy is easy. Hire good help, and be a gentleman. I know a farmer who will spoil a good hand in a few weeks. He is forever crowding and rushing, so as to get some particular piece of work done by such a time, and such a time is always too short a time. A fresh hand will work like a beaver for him for a few days, thinking that when the man gets a little over his hurry work will go on with more moderation and regularity; but the new hand soon learns the truth. He finds he has got into an atmosphere of hurry, disorder and confusion. So he makes a mule of himself, settles back into the breeching, and lets the master drive. How much better a man feels doing a good day's work willingly and cheerfully, than he does doing the same work when he is crowded beyond his strength, and nettled with coarse jokes and stinging sarcasm!

There are men,—and I wish there were more,—who have hired a great deal of help in their day, who have never given to a hired man a disrespectful word. And such men are not troubled with saucy help. Most hired help don't want to hear anything about their work at the table. I know a gentleman, and have worked for him many days, who always has several men about him, building or farming, sometimes both, and from anything heard at his table, —we always ate with the family,—you could not tell what the men were doing. Yet after dinner they all slipped quietly out, and went about their business. That man's help always had the name of doing well for him. There was always an air of cheerfulness and respectability all around there.

Give the hired men a scraper, mat, and broom for their boots. How often do they come up to the house for their meals, from some muddy place where they have been at work, and look in vain for either. I am sorry to say there is once in a while a man who inclines to mud, but most men would be neat and clean if they could.

There are few ladies who will not notice a muddy boot when it comes into their dining-room. If the wife has succeeded in making her husband neat and tidy in his habits, she can make him furnish tools for cleaning the hired men's boots.

Give the men also good conveniences for washing, wiping and combing. Such conveniences cost but little, and the men will feel better, look better, and do enough better to pay for them ten times over. Think of half a dozen men waiting to get at one little greasy skillet to wash in, and then taking their turn at a hand's breadth of towel that used to be dry and clean.

Allow me to tell a bit of pleasant experience relating to this branch of the subject. John and I worked for a farmer once. John is a fellow mason. The farmer wasn't rich, but he was able to furnish a large maple block to set the wash-dish on, castile soap, a pailful of warm water for us to wash with, and a dry towel for us to wipe on, and a broom, scraper and mat for our boots, and did furnish them. Many times since, when we have been where they did not have very good accommodations for washing, John speaks of it and says: "That was a pretty good place to wash, at G——'s. Gosh! I think of that a good many times!" Two winters after, John took a large job of cutting cord wood; hired a few men; built him a log shanty, and stayed right in the woods, where his work was. I went in one day to engage John to go, in the spring, on to an early stone job. He asked me into his shanty. In one corner, upon a rough bench, were two wash-dishes, and a lump of castile soap, and over it hung a heavy, clean, dry towel. When I noticed these John saw me. Neither of us said a word, but we exchanged smiles, as much as to say: "You and I know a few things."

Give the hired men a cool, airy dining-room, if you can. You needn't give them much pie, or cake, or other dainty food. If you have given them a good chance to make themselves tidy, and then greet them with a smile and cheerful word as they come into a cool, clean dining-room, and take their seats at a table where there is plenty of elbow room, they won't miss the plum pudding or the "stalled ox." They will make a hearty meal on plain food.

Make the meal time as pleasant as possible, so the tired laborer shall not only take comfort eating, but shall also for a short time forget his toil and obtain a little rest.

"Thou shalt not muzzle the ox that treadeth out the corn." I heard of a man once, though, who would not let his hired boy drink sap when he was at work in the sugar place.

Last spring, a farmer in a neighboring town said to his hired man, whom we will call Sam, though that is not his name: "Sam, do you know how to raise melons?" Sam answers: "I *have had* good luck raising melons." "Well, Sam, I want to make an arrangement with you. I will furnish land, manure, seed and time, and you shall raise the melons. Next fall we will take what pleasure we can, eating them." Nice arrangement, you see. Sam agreed to the plan at once. Last August I saw the man, and Sam, and the melons. The man told me how Sam did it, and gave him all the credit for the success of the experiment. It was a success. There was nearly a cart load of melons on a piece of ground twenty-five or thirty feet square. I was so glad to think that Sam would have a happy anticipation all the long summer through, every time he thought of the melons, that I did not regret they were not ripe when I saw them. I should expect the man who understood and meant to obey the injunction quoted above, would now and then make some such arrangements with a hired man as this that was made with Sam.

Lastly. The laborer is worthy of his hire, and he must have his pay promptly when his work is done. This obligation, although last in order, is *first* in importance. If you owe more debts than you can pay, be sure you pay the man who has earned his wages. That is a kind of a first mortgage.

There is many a poor man who is too proud or bashful to tell you that unless you pay him that night for his day's work, his family will have no breakfast next morning; or, unless he can have his pay to buy him some undershirts, he must go shivering about his work the next chilly day. See to it that such men are paid often. We are, more than we think, perhaps, their keepers.

In the best book I ever saw is this law, Lev. xix:13: "The wages of him that is hired shall not abide with thee all night until the morning." And again, Deut. xxiv: 14, 15: "Thou shalt not oppress an hired servant that is poor and needy. At his day thou shalt give him his hire, neither shall the sun go down upon it, for he is poor and setteth his heart upon it."

A man that works in my neighborhood nearly all the time by the day, told me he once worked for a man who was able to pay his debts and more too, and that at one time when he had been at work for him a few days, the gentleman owed him more than enough to buy a barrel of flour, and instead of getting his pay at once, and buying his flour by the barrel, he got seventy-five cents, one dollar, and one dollar and fifty cents at a time, and was obliged to buy his flour by the pound, thus losing at least half a dollar of his hard earned money, besides the extra time it took to run after a few pounds of flour at a time. That was clearly a violation of the law before quoted.

For the credit of all the men I ever worked for, I will say that I never lost a cent that I earned; and for the credit of all the men who ever worked for me, I will say that they have been smart enough to get *their* pay.

There is something besides muscle that affects a hired man's value. And men when they hire out take into consideration other things besides a specified amount of money.

When you hire a man, if you know he has a well established reputation for promptness, honesty, fidelity, obedience, intelligence and skill, you are willing to pay him three to five dollars a month more than you would pay the man with a doubtful reputation. And if you have the reputation of being respectful, kind, and considerate to your help, and of paying them honestly and promptly, you will have no trouble in hiring good help, if there is any to be hired.

THE SAND BLAST AND ITS APPLICATION AT WEST RUTLAND, VERMONT.

BY J. B. SMITH, A. M., M. D., OF WEST RUTLAND.

It has been long known to geologists, that very much of the erosion or abrasion of even the hardest rocks, is the result of fine sand being driven against them by high winds at some period after their formation. The pyramidal, conical and grotesque shapes of often detached masses of rock on the Western plains, the "Monument rocks" in the "Garden of the Gods," at Colorado City in the Rocky Mountains, and the singularly grooved formations in many of the California group, are all attributed by the best scientists to the action we have named, probably coupled with more or less aqueous agency. At the present time, wherever masses of stone are exposed to drifting sand, as in the desert, this attrition process is going on with more or less rapidity in proportion to the force of the agent. The Pyramids and the Sphinx, have for hundreds of centuries faced these currents, and bear upon their faces the impress of this force. Some years since the attention of a distinguished chemist of Philadelphia being directed to this subject, he undertook a series of experiments with the view of making some practical application of this knowledge to the arts. The experience of every-day life, taught him that a grain of sand simply rubbed with the finger upon a piece of glass, would wear the surface and produce a perceptible effect. Reasoning from this, he inferred that if he could bring a strong current of sand to act in a similar manner, a proportionate effect would be produced, and increasing his operations, through patient labor he finally perfected the invention now known as the sand blast.

For this interesting and valuable machine or appliance, we are indebted to Prof. B. C. Tilghman, of Philadelphia, who has obtained patents for it both in America and Europe, and received from the scientific world in general the highest acknowledgments.

The inventor followed up his experiments upon glass with other harder substances, finding equally as practicable results on sandstone, marble, and even flint itself, recent experiments proving that it can be used for the lapidary work upon gems. At some future time, perhaps, I may have the liberty of presenting before your honorable Board the history and progress of the noble work which the Government has undertaken, in setting apart, embellishing and adorning National Cemeteries, forthe grand army of the Union dead, a work unexampled and unparalleled in the history of any nation, and a work that will forever stamp this free people with the seal of a broad, charitable, human heart. It was in connection with this work, that the War Department advertised for proposals for headstones for every grave in those cemeteries containing the remains of a Union soldier, whether his name was known or unknown; and the contracts under which these are now being executed at

West Rutland, were undertaken at a low figure through the ability to utilize the sand blast for the purpose of lettering the inscriptions. This is the first, and really the most extensive application of the patent, and is due entirely to the energy of Mr. Samuel G. Bridges, of Keokuk, Iowa, one of the contractors for these headstones.

To enable you to understand the work we are doing at Messrs. Sheldons & Slason's mills, at West Rutland, I will, as briefly as possible follow the marble from the quarries, to the finished headstone on our platform ready for shipping. The immense facilities which this firm possess, render them probably the only one in the world who could furnish the material for this work within any reasonable time.

The huge seven ton blocks taken from the quarries, are skillfully sawed in their forty-eight gang mills, (running night and day,) into first, four inch slabs; then these are *resawed* into ten inches wide strips, and thus delivered to the blast mill, in headstone stuff from three feet to three and one-half feet long; making the slab for our use three feet by ten inches by four inches, as required by the contract. Each of these slabs is squared by hand on one end, and rounded on an inch circle at the other, first roughly, then by passing through a cutting machine, consisting of two cylinders bearing sets of knives revolving rapidly on the head of the stone, as it is carried by cogs across their edges.

The head is next placed against a wooden wheel fed with sand and water, by which the polishing is effected. The edges and faces are then polished by being laid under revolving cylinders of wood, running on hollow shafts, through which is fed water, while the polisher occasionally throws sand on the stone. This polishing process is a vast improvement on the hand work, both as to time and the quality of the work done.

The slab, when dry, is now ready for the first operation to fit it for the blast. It is laid flat on a bench, and the lettering boy spaces the surface out accurately for his work. The inscriptions are furnished by the Government, in the form of printed lists, each grave being numbered, and we are required to correctly and artistically cut these on the slabs. The letters used are one inch long, made of malleable iron chilled, and bevelled from the base to top. The boy now selects from the type box the letters comprising those forming the name he desires to set, and the figures for the number; these he places upon a hot griddle, rubs a bit of hot shellac on their bases, and sticks them on the stone. The slab is now ready for the blast.

The sand blast proper is made up of an apparatus through which sand and steam pass and strike upon the stone. This apparatus is made up of four pieces: the sand tube, or cylinder, the steam tube, or gun, the socket, and the barrel. The sand tube, or cylinder, is a thin iron tube, three-eighths of an inch in diameter, and six and three-fourths inches long. The steam tube, or gun, is a hollow, globular shaped casting of brass, with an aperture on the side to admit steam. The socket is an appliance connecting the gun with the barrel. The barrel is of chilled cast iron, as hard as can be made, six inches long and one-half inch in diameter.

The apparatus complete is the gun with the sand cylinder passing through it, the socket and barrel fitted to it.

The sand used is from Long Island beaches at Northport. It is first dried and then placed quite warm in a small box ; this is elevated about seven feet above the floor, and outside the blast room. The bottom of the box is perforated with about a half-inch hole through which passes a tin tube about the same diameter, and terminating with an open extremity over a small funnel, to which is connected the rubber tubing which conveys the sand through the partition of the blast room to the sand cylinder in the gun.

The blast is in a room by itself, open by door externally and by ventilator overhead to carry off the steam and facilitate the cleaning up of the sand. Upon a wooden platform is laid a pair of parallel iron tubes acting as tram ways for a set of wheels,carrying a movable table or bed, upon which is placed the slab to be blasted. This bed is connected, by a mechanical arrangement of cog wheels, with the driving machinery of the blast, so that it moves the slab forward lengthwise while being blasted.

Directly over this movable bed is placed the blast gun. The steam is supplied from the main boiler through steam hose, which is held over the gun by a pair of rollers moving backward and forward by an ingenious contrivance, and which carry the gun transversely across the face of the slab, while the slab is moving lengthwise beneath. The gun itself is a hollow cylinder, admitting the steam on its side, and when the sand tube is inserted, it becomes a double cylinder. When the slab is placed upon the table, an iron plate, cut out to leave an open shield about eight by ten inches, is laid on the head of the stone, and a weight is laid upon it to prevent its moving during blasting. There is now exposed to the action of the blast, the marble surface not covered by the iron letters within the outlines of this shield.

All being ready, the steam is turned on, and by a driving pulley on the main shaft of the engine, the gun in motion is carried across the face of the shield, and at the same time the slab moves along gradually under the blast. The sand has hitherto remained in the little funnel, there not being pressure enough to force it down, but the moment the steam is turned on the gun, it sucks down, so to speak, the sand into the sand cylinder, and the sand and steam meeting at a point below where the steam enters, are both forced down upon the exposed marble face. The work now performed is a mechanical one. Every grain of sand is a miniature chisel, cutting out a particle of marble, at the rate, perhaps, of a hundred thousand particles a second, and as the slab moves slowly along, bringing successive surfaces beneath this cutting process, the face of the slab soon becomes cut out, to a greater or less degree, everywhere except beneath the letters and the outline shield.

After about four minutes the slab will have moved up as far as the required length of the shield, the steam is turned off, and the machinery stopped. The slab is now taken into the mill, and the letters blown off by a little jet of steam ; the stone is washed off, and piled on the platform ready for shipping.

As with all other new inventions, there have been defects to overcome, and many obstacles to remove. It took Prof.

Tilghman a long time to perfect his invention, to make it a success. The manner of introducing the stream of sand required patient study and experiment; the flow must be regulated by the quantity required, and only as fast as needed. This he accomplishes by carrying the steam into the gun *above* the sand entrance, by which the pressure acts as a syphon in drawing the sand down, and ceasing the moment the steam is shut off.

The proper distance between the end of the blast tube and the face of the stone was a matter of study and costly experience on the part of Mr. Bridges, (who first demonstrated the availability of this apparatus for lettering on marble to any extent). If the blast is an inch too close the steam blows off the letters, and if an inch too far away the blast loses its effect. Experience shows that nine inches is just right for our work.

The force of steam required has only been determined by long trial; we are using from one hundred to one hundred and twenty-five pounds; less than ninety-five pounds will not accomplish any satisfactory results.

The kind of sand is important. At Keokuk, Iowa, where this work was done to a small extent last season, we found the island shoals or bars of the Mississippi River afforded the best cutting sand. These are made up of the broken down particles from the trap and other hard rocks of the upper Mississippi, thoroughly washed by the river current from earthy impurities.

At West Rutland we tried the sand from the adjacent sand pits, but it is altogether too crumbly and impure. Then we experimented on sand brought by Messrs. Sheldons

& Slason from the beaches near Boston, but found that the decomposed granitic rock of the Eastern coast is composed of too soft feldspathic and micaceous material. Finally, these gentlemen brought sand similar to that they had been accustomed to use in their mills, from Long Island, as before mentioned, and this we find *sharp* and most desirable. The sand can only be used *once* for the blast; it becomes so divided and devoid of sharpness afterwards, as to be useful only for polishing.

The manner of putting the letters on the stone was a long study. A long list of gums, resins, &c., were tried, until we reached the *shellac* of market, which is the only substance thus far successful; it is for convenience simply heated and drawn out into sticks. The barrels were our last and are still our principal trouble. They must be as true as possible in their interior diameter; they must not vary from this diameter 1-32 of an inch; they must be as *hard* as can be made, and they must be as *cheap* as possible, for their consumption is large. After many attempts, we are having them made at Troy, New York; but all our efforts are so far in vain, to prevent their cutting out on the sides after only four or five hours' use. There is a very powerful agent at work on them you will readily perceive, but why at this *one point*, almost invariably, this "cutting out" takes place, and which will take place in barrels made of the hardest chilled cast steel, is yet to be determined.

We have also to contend with irregularities of texture in the marble itself; "flint streaks," which are not cut away as fast as the softer marble, and stand out on the face as "ridges." We have frequently an undulating, wavy appearance of the face, caused, perhaps, sometimes by the inequality of the texture of the marble, and sometimes by the variations in the movement of the blast across the surface; for if the blast stands but a fraction of a minute on any part of the slab, a deep hole will be cut proportionate to the time it is stationary. A very few minutes will drill out two inches or more.

Without the utilization which Mr. Bridges effected of this simple yet wonderful invention, the enormous contract of completing and setting up in all parts of the country these headstones, would have been almost impossible. At all events, the work would have required long time, and cost the Government hundreds of thousands of dollars more than is awarded for this work.

The applications of the sand blast are multiplying almost daily. The etching of dainty designs on windows, the rich ornamentation of goblets, vases, etc., the delicate frosting on silver, are among its uses, while channelling and grooving in quarries may yet be accomplished by it.

This nineteenth century is wonderful in its record of brilliant inventions and startling discoveries. In its dawn it looked upon the steamboat and the railroad, and scarcely had it recovered from these gigantic strides in the march of improvement, before the lightning was harnessed to its triumphal car of progress, and made to flash human thought from continent to continent, over land and sea. The little prism that had been a mere scientific toy to separate the beautiful colors of the rainbow, has become a great analyzer of chemical compounds themselves, and across whose spectrum the scientist now finds the lines detecting the faintest presence of the rarest mediums, even in the rays of the sun, and reveals to us some of the mysterious compositions of that great light and life giving orb.

The nauseous and refuse waste of our gas houses is collected and distilled into the rarest and most delicate shades of color, and the most fragrant perfumes. And way down from among the pines, the lepidodendrons and the liliaceæ fossils of the coal beds, come pouring up vast reservoirs of oil to light the world.

While now, in our own day, silently and slowly creeps up a simple combination of steam and sand, which starts out on its journey to waken new life, and create new forms of usefulness, and aids to point to all ages to come, the sacred spots where lie entombed the ashes of our patriotic and honored dead.

THE WATER POWER OF VERMONT.

BY HENRY CLARK, OF RUTLAND.

On the map of the western continent, the State of Vermont is but a speck. Her climate is severe and inhospitable. Her soil is so rugged and in some portions so difficult of cultivation, that its meagre products are more a tribute to the skill and industry of her husbandmen than to any native generosity of mother earth. Her geographical inland position allows no opportunity for a commercial center. Though her quarries of marble, slate, granite, soapstone, are unsurpassed, her mineral resources dwindle into insignificance when compared with those of the Middle States, the West and the far West.

Wanting in these elements that form a foundation for the prosperity of a State or nation, nature, as if seemingly mindful of her neglect, has placed at her disposal one of the mightiest of visible motors, a gift too precious to be carelessly squandered, because unappreciated and unknown. To the hundreds and thousands of summer visitors who annually seek her hills and valleys to recuperate their health, and pass the heated term in idleness and pleasure, it scarcely occurs that from these hills and valleys flow hundreds of streams, furnishing in their course, here and there, that which might lay the foundation of great wealth to our State. Nature at best makes but few spontaneous contributions to the wealth or prosperity of a nation. The amount of property possessed by a people will always depend greatly upon the skill and labor they apply in developing natural resources. Vermont has not, to a considerable extent, improved the advantages at her command, but as she has improved them, so has she prospered, but not to her fullest extent. More than three-fourths of the water power of the State is undeveloped and unimproved.

Some years since our Legislature, by joint resolution, instructed the Secretary of State, by a series of questions, to ascertain the value and availability of the water power of the State, but it calling only for voluntary responses, but little valuable information was obtained. Yet sufficient, I apprehend, to suggest somewhat the value of the power of our rivers, ponds and lakes for use. As no appropriation was made to meet the expense or carry on the investigation, the work was measurably abandoned or turned over to the Board of Agriculture, Manufactures and Mining, with a view of a hydrographic survey; but providing no means for its accomplishment. This is a matter of regret as it was, and still is, the only reliable means of furnishing information on a subject which should be foremost to those who have the prosperity of the State in view. I have been able to gather some information and have given much thought and time to the subject, which, though incomplete, will serve to draw attention to something of the wealth that lies in Vermont's lakes, ponds, rivers and brooks.

The extreme length of the State is 157½ miles and the average width is 57½. Its entire area is 9,056¼ square miles, or 5,796,000 acres, and a large amount of this territory is covered with water.

The Connecticut basin embraces that portion of both Vermont and New Hampshire whose waters are drained into the Connecticut. It receives the waters from 37,000 square miles of territory. The Connecticut receives from Vermont, besides numerous smaller streams, the waters of the eleven following streams: Wantastiquet, or West River, Saxton's, Williams, Ottaquechee, Black, White, Ompompanoosuc, Waits, Wells, Passumpsic and Nalhegan. The Clyde, Barton and Black rivers run northerly into lake Memphremagog. The Missisco, Lamoille, Winooski and Poultney rivers and the Otter Creek flow westerly into Lake Champlain, and the Battenkill and Hoosic westerly into the Hudson. The Deerfield river runs southerly from Vermont and enters the Connecticut in Massachusetts, and the Coaticook and Pike head in the northern part of the State and run into Canada, the former uniting with the Missiwappa river at Lenoxville, and the latter falling into the head of Missisco bay.

The Wantastiquet receives the Winhall, Bald Mountain branch, another branch from Wardsboro, Meadow branch, and in Newfane South and Smith branches. The Wantastiquet affords few water privileges, but its branches afford much available power. This river receives the waters from about 440 square miles.

Saxton's river is formed by the union of several streams and is capable of affording a large power. Williams river is formed by three considerable streams and affords good facilities for improved water power.

Black river, in Windsor county, is 35 miles in length, and waters about 160 square miles, affording the power for the flourishing manufacturing villages of Ludlow, Proctorsville, Cavendish, Perkinsville and Springfield, and has the capacity of carrying a hundred more mills of equal power than now stand upon its banks. This river is remarkable for the number of natural ponds through which it passes.

The Ottaquechee receives two considerable mill streams in Bridgewater. In Woodstock, two other branches of considerable size, and in its course receives numerous other streams. This river and all its tributaries have most excellent water privileges which could be used ten if not twenty fold of their present use, and if facilities of transportation were adequate every available site would be occupied. It is about 35 miles in length and waters about 212 square miles.

White river is the largest stream in Vermont on the east side of the mountain. Its length is about 65 miles and it waters 680 square miles. It rises in Granville, in Addison county, running through Rochester, Hancock, Pittsfield, Stockbridge, Bethel, Sharon, Hartford, and enters into the Connecticut about five miles above the Ottaquechee. From its source it runs slowly through a narrow tract of intervale until it arrives at Stockbridge, after which the current is very rapid until it reaches Bethel village. From Bethel to its mouth the channel of the river is from 16 to 18 rods in width and the current generally rapid, and the water shallow. On account of its proximity to the Ottaquechee, it receives no large tributaries from the south. From the north it receives three large branches, called the first, second and third branches. The first rises in the town of Washington, in Orange county, near the head of Waits and Winooski rivers, running through Chelsea and Tunbridge, and unites in Royalton. The second branch rises in Williamstown in conjunction with Stevens' branch of the Winooski, and running southerly through Brookfield and Randolph, enters White river near the center of Royalton. This tributary runs with a gentle current through a narrow tract of fine intervale. The third branch originates in Roxbury, in Washington county, runs through Granville, Braintree, and joins at Bethel village. Each of these streams is about 20 miles in length and affords large resources of power, especially at the village of Bethel.

The Ompompanoosuc rises in Vershire, passes West Fairlee, Thetford, where it receives a considerable increase from Fairlee lake, and enters the Connecticut in Norwich. It receives other tributaries in its 20 miles course, and affords some of the best undeveloped water power in the State.

Waits, in its main branch, rises in Harris' Gore, in Washington county, passes through Topsham, Corinth and a branch through Washington, and joins at Bradford. This river and all its branches are lively streams and afford a large power. In Bradford, where this river is crossed by the main road leading up the Connecticut, it has many falls, affording excellent improved and unimproved power.

Wells river has its source in a pond in Groton and falls into Long pond in the same town, which is about 2 miles long and 100 rods wide. From this pond in about half a mile it falls into another pond, after leaving which it receives several tributaries, passes through Ryegate and enters the Connecticut in Newbury. This is generally a rapid stream and has with its tributaries large undeveloped resources.

The Passumpsic river is 34 miles in length, having its source in Westmore, in Orleans county, passes through East Haven, Burke, Lyndon, St. Johnsbury, Waterford and Barnet, and falls into the Connecticut about a mile below the foot of 15 mile falls. From its source until it reaches Lyndon, it is a swift stream. The greatest part of the way through St. Johnsbury it is swift and has some large available falls in Barnet. Its improvable power is large.

The Nalhegan waters about 120 square miles and is 3 rods wide at its mouth. It originates in Averill, in the woods of Essex county, and falls into lake Memphremagog. It is generally a rapid stream. It has a vast number of rapids and much State legislation has been had for its improvement.

Clyde river has its source in a pond near Island pond, in the town of Brighton, running through Charleston, Salem and Derby to lake Memphremagog. Excepting a few short rapids, it is a still, dead river until it comes within three miles of the Magog lake. The Clyde runs through Round pond and Salem lake, about 2 miles in length. It waters about 150 square miles.

Barton river originates in that town. One of its branches originates from the fountains of the famous Runaway pond. Another branch rises from two small ponds on the line between Sutton and Sheffield, and after running through

Belle Pond unites with the stream from Glover. These united waters receive Willoughby river, which rises from a pond of the same name in Westmore. It waters about 160 square miles.

Black river, in Orleans county, is formed in Craftsbury by the united waters of Elligo and Hosmer's ponds, and Trout branch, running through Irasburgh and Albany, and falls into South bay of lake Memphremagog in Newport. Its length is 30 miles and it waters about 150 square miles. There are a few eligible water powers on its course.

Missisco river rises in Lowell, Orleans county, running through the towns of Westfield, Troy, Potton (Canada), Richford, Berkshire, Enosburgh, Sheldon, Highgate, and falls into Missisco bay near the Canada line. There are several falls and rapids in this river, but the current is generally moderate and the river wide and shallow. It affords a large number of valuable sites for mills and factories. Black creek and Taylor's branch are its most considerable tributaries. The length of the river, including its windings, is about 75 miles, and it receives the waters from about 582 square miles. It is navigable for vessels of 50 tons burden to Swanton Falls.

Lamoille river formerly rose in a bed from a runaway pond in Glover. It is now formed by a union of several streams in Greensboro. It is joined in Hydepark by a considerable stream which issues from Caspian lake in Greensboro, receives other tributaries in Wolcott and Cambridge, and falls into lake Champlain in Colchester. The current is generally slow and gentle above Cambridge; between there and the lake there are considerable falls. It is valuable for its unimproved water power. It is not as large as either the Winooski or Missisquoi.

The Winooski river is formed by the union of several small streams in Cabot, receiving a large increase from the east which originates in Onion river pond in Peacham, and in Molly's pond in Cabot. On this stream is a remarkable cataract, where the water falls 300 feet in the distance of 30 rods. The main river runs through Plainfield, Montpelier and other leading towns, and falls into lake Champlain, five miles north of Burlington. Its most considerable tributaries are Dog river, Stevens' branch, North branch, Mad river, Waterbury river and Huntington river. The Winooski is rich in water power nearly its entire length, and the largest manufacturing village in this State is located on its banks and improves its riches. It is one of the largest in the State, being about 70 miles in length, and watering nearly 1,000 square miles.

Poultney river rises in Tinmouth, running through Middletown, Poultney, Fairhaven, West Haven and Hampton, N. Y., and falls into the head of East bay, which is an arm of lake Champlain. Its length is about 25 miles. It affords some of the best mill sites in the State, and in this regard at Carver's falls is unexcelled in the State, caused by a peculiar change of its channel in 1783, which cut a channel 100 feet deep, lowering the bed of the river for some distance above and carrying immense quantities of earth into East bay.

The Otter Creek is the longest river in Vermont, its whole length being 91 miles, watering about 900 square miles. It originates in Mt. Tabor, Peru and Dorset, within a few rods of the head of the Battenkill, and runs north through the entire length of Rutland county. It receives along its course valuable contributions of water. At Sutherland Falls, Middlebury and Weybridge are valuable falls which alone afford water power for the use of millions of dollars in manufactures. There are already located upon its banks some of the finest manufacturing establishments in the State.

The Battenkill is 44 miles in length, about one-half of which is in Vermont. It waters in this State about 225 square miles, and affords many excellent mill privileges, and its banks afford many valuable sites for manufacturing.

There are hundreds of smaller streams tributary to our larger rivers, which afford most valuable water power. The varied smaller lakes and ponds which dot our State possess millions of wealth in the water power they afford if rightly improved. I will not detain you longer to particularize, but proceed to draw conclusions from the facts as they suggest themselves.

The Connecticut basin forms the eastern portion of the State through almost its entire length, comprising the counties of Windham, Windsor, Orange, Caledonia and Essex, and is, of course, the leading water power of Vermont.

The leading characteristics of our water power are:

1. The great number of water powers in proportion to the territory. The more important falls on the larger streams are known to all, but the working, wealth producing force, scattered almost throughout the entire length and breadth of the State, is almost incredible when fully considered.

Less than one-third of the towns reported a few years ago, to the Secretaty of State, over 500 available water powers.

2. The small percentage of available water power developed and in actual use. There are a score or more of localities at which there is sufficient water power to establish centers of wealth equal to some of Massachusetts' manufacturing districts, running entirely to waste. By the side of one of the great thoroughfares of travel are a whole series of water privileges which would yield in some localities a working force of 10,000 men, in others 15, 20 and 25,000 men. These have been waiting for hundreds of years, and are waiting still, to be pressed into the service of man. What they might add to the population and wealth of the State, through the proper application of capital and enterprise, can only be estimated by thousands and millions. Along our railway lines are magnificent water powers, sufficient to move the combined machinery of Manchester, N. H., applied to turning only the wheels of one poor lonely paper mill. In addition to all these unoccupied, in many places in which the powers are reported as *occupied*, less than 33 per cent. of the available power is made use of. Many mills are operated by leaky dams and by ancient water wheels which belong to another age than ours. Lakes and ponds which ought to be nature's great storage basins of water, are but half appropriated or not appropriated at all.

In addition to these general characteristics of Vermont's water powers, it might be observed, as an important consideration, that wood, timber, marble, slate and granite are abundant in close proximity. Steep descents and abrupt rapids give to these privileges their chief value, and they would long ago have been obliterated had not nature preserved them with floors and walls of rock. These are the several characteristics of Vermont's water powers. They are the source of her future wealth, her only hope for the future, the very life of the State. It is only through the full development of these gratuities of nature, that Vermont will grow into a wealthy and populous State. It is time that her people ceased to go West, it is time she lost the reputation of a good State to emigrate from, it is time that her sons and daughters ceased dreaming of fortunes to be had for the seeking in some El Dorado, while a river of wealth is constantly idly flowing down her rocky hillsides and through her pleasant valleys. Work is the price all must pay for the necessities as well as the luxuries of life. Within the last two decades the population of the farming towns of the State has been wonderfully depleted, a witness of which can be seen in the hundreds of deserted farm houses on every hillside and in every valley. In 1860, there were more people under 50 years of age than in 1870. While in the same period those of 50 have increased. Probably 5,000 of this number gave up their lives in the rebellion; still it is evident that the great cause of this is in the emigration of the young to seek employment elsewhere, leaving the older persons at home. The population of 1870 falls nearly below that of 1860, while with that of the increase of foreign population it is hardly more than in 1850. These figures tell their own story, hinting only too plainly to what the population is drifting. What is the lesson they teach? That it becomes the people of Vermont to make the best of what nature has so bounteously given them, by pressing from their wasting water powers every service of which they are capable.

What the future will add to our present productions depends entirely upon how thoroughly the water powers of the State are utilized. A member of the Royal College of London, in a work upon the coal question, tells us that the greatness of the British nation hangs upon "a few lumps of dirty coal." Is it not equally true that we of Vermont are to draw our future prosperity from the thousand streams that run down our mountains and through our valleys?

ISAAC TYSON, JR., IN VERMONT.

BY J. W. STICKNEY, OF TYSON FURNACE.

Isaac Tyson, Jr., late of Baltimore, Maryland, who died in that city in November, 1861, was, during his business life, one of the most noted mineralogists of that period; and there are few, even now when science has advanced, and the American schools take equal rank with the best schools in Europe, that are in advance of his knowledge and attainments forty years ago, in mineralogy and kindred sciences. At the age of eighteen years he was sent by his father from Baltimore City, to take charge of a ship's cargo bound for the Mediterranean. The ship was wrecked on the coast of France. The crew were saved, but the ship and cargo were a total loss. Being left destitute and among strangers, application was made for assistance to the United States Minister, who supplied them until other means to pay expenses arrived from Baltimore.

In writing home for funds to return with, young Tyson expressed to his father a wish that he might be permitted to stay in France and finish his education. To this his father consented, and he was allowed to remain in the French schools until he had become of legal age to act for himself. Having perfected his knowledge of geology, mineralogy and chemistry, so far as attainable in the French schools, he returned to Baltimore City. At that time the French were the only nation that had a practical knowledge of the process necessary to manufacture chromate of iron so as to produce bichromate of potassa, chromate of lead (chrome yellow), and other products of chrome ore.

Mr. Tyson, from what knowledge he had acquired of minerals before leaving home, became quite positive, when in France, that the chromate of iron was abundant in Maryland, and near the City of Baltimore. In searching for that ore, after his return home, he found his dreams of its abundance more than realized, within fifteen miles of his father's residence. By the assistance of his father, he purchased a tract of land, and the chrome product of that purchase laid the foundation of the large fortune he left to his heirs at his decease, and also provided him with means to explore for minerals in the Eastern, Middle and Southern States, resulting in a lasting benefit to the mining interest, and giving an incentive to search for minerals that will be felt long after the marble tablet that marks his last resting place has gone to decay.

In 1828 Mr. Tyson began to take an interest in the minerals of Vermont, and he soon after became in part owner of a copper mine in the town of Strafford, copper ore having been discovered there in connection with the sulphuret of iron, from which the sulphate of iron (copperas,) was manufactured, occurring in small veins and pockets. Works for smelting were erected, and copper was produced in a small way until 1839, when it was abandoned, Mr. Tyson having previously sold out his interest in the mine. During the time Mr. Tyson was connected with the Strafford mine, he, in company with others, commenced the opening of the now celebrated copper mine at Vershire, which is nearly in the same geological range with the Strafford copper. The outcrop of the ore being high up on the southern slope of a hill, Mr. Tyson at once decided to drive a cross-cut adit from the foot of the slope and strike the ore many feet under its outcrop. This adit was worked for nearly two years, and a distance of ninety-four feet, driven into the solid rock in the right direction to cut the vein at the most direct point, when his associates in the enterprise became discouraged, and the workings were abandoned, contrary to the wishes of Mr. Tyson, who had full confidence in the final result.

To show his foresight, based on good judgment in mining operations, it would be in place to add here that after some years other parties took hold of this opening for copper ore, and drove in the same adit four feet farther, and came to a rich vein of copper ore.

Some years after the Vershire mine had been abandoned, he began to mine for copper ore in Waterbury, by sinking a shaft where an outcrop of ore appeared on the surface. Before the shaft had been sunk to a depth that would determine the value of the vein his health failed, and further investigation was postponed, not to be resumed in his lifetime.

Mr. Tyson's most extensive work in Vermont was done in the south part of the town of Plymouth, named by him Tyson Furnace.

Crossing the Green Mountains from the west, in 1835, in search of minerals, he hit upon surface indications of iron ore, in a valley near the head waters of Black River; and the same year he sent Joseph Martin, an experienced miner and foreman of the works in Strafford, to take charge of the prospecting for iron ore in Plymouth. Mr. Martin examined the mineral outcrops for six miles down the valley of Black River to the south line of the town, and discovered and opened three workable ore beds in 1836. Two of these were composed of the magnetic and micaceous oxides of iron, and one of brown hematite.

In the spring of 1837, Mr. Tyson began to erect buildings at Tyson Furnace, and the first of the next December had in full operation what was then considered a large blast furnace. He had also built a store and warehouse, coal sheds, and three tenant houses. The following year he erected a huge warehouse, machine shop and tavern house, together with a school-house, agent's house, and houses to contain twenty families, for the miners and furnace men. A reading room for the workmen, supplied with books and newspapers, was provided, and a post-office, and a mail route established; and all the elements of a New England village sprang up as if by enchantment.

In connection with the 300 acres first purchased for furnace and ore purposes, Mr. Tyson purchased a pond at the head of the stream that furnished the power to blow the furnace, and erected a dam which flowed over some 600 acres, making an ample supply of water through the dry seasons of the year. He also purchased 2,500 acres of wood land for charcoal and timber purposes, making up an outlay of some $60,000 in two years for real estate and building purposes, being all done single handed, without any act of incorporation or partnership assistance.

The next year a timbered adit was driven 1,400 feet, to drain the hematite ore bed. When something more than one-half the distance was completed, a bed of kaolin or pipe-clay was discovered, the more westerly part of which was inter-stratified with quartz sand which was afterwards extensively used for moulding heavy castings.

The product of the furnace was from 600 to 1,000 tons of iron annually, the most of which was made into small castings consisting of stoves, hollow ware, mill gear, plows and water pipe. After about seven years, the re-casting part of the works was given up and the iron was sold in the pig. The furnace run with varied success until 1853, when the failing health of Mr. Tyson precluded him from active business, and the works stopped until after his death, and until sold by his executors.

It was Mr. Tyson's opinion that the hematite ores of the tertiary formation were the most reliable to mine in Vermont, and the most valuable in their product ; that the ores of iron that were formed in the oldest rocks in the gneiss and talcose slate were in irregular veins or pockets of small dimensions ; that if they were inter-stratified the stratification was irregular and much misplaced and torn asunder by upheavals, and that surface indications could not be made a criterion by which to judge of the extent or quality of an ore. Also that the carbonates of iron found in this formation would contain impurities that would preclude their being smelted successfully. These opinions have been proved correct by costly experiments since his death.

He valued the hematite ores on the west side of the mountain as being among the best iron ores on the continent, and after an examination of different beds, extending from Bennington to Bristol, he purchased a right in the Train ore bed in Tinmouth, and had it opened and put in working order, just at the close of his life, this being some of his last work in this State.

His love for the beautiful in nature made him delighted with Vermont scenery, and much of the heated term of each year was spent in the State, either at Strafford or Tyson Furnace. He visited Europe often when in health, and the improvements there in the arts and sciences were noted and brought back with him for the benefit of the land of his birth, and Vermont obtained her full share of these benefits. One of the first hot-blasts for blowing a furnace in this country was put in to the furnace at Tyson, having been cast from patterns modeled from diagrams procured by him in England.

His religion was strictly of the Friend Quaker stamp, and in his dealings and business relations with the world there was a conservative honesty that would be refreshing to witness *now*, an honesty that young America will never be likely to behold.

REPORT

OF THE

State Geologist

AND

CURATOR OF THE STATE CABINET.

REPORT OF THE STATE GEOLOGIST.

To His Excellency, ASAHEL PECK,
Governor of Vermont :

SIR :

I have the honor to present the following report in relation to my department, for the years 1875, and 1876. As there is no appropriation by the Legislature, to enable me to examine the mining sections of the State, or even collect the statistics of the same, I am, of course, unable to give a definite report.

The marble interests, notwithstanding the hard times, are still, as they must be for years to come, on the increase. They pay reasonable profits on investments made, and as the marble improves with depth in most of the quarries, the future prospect is flattering.

The quarrying of granite, and porphyry, has been on the increase, and it is found that our granites when polished are scarcely inferior to the Scotch granites, so much used in Europe, and recently in this country. Among the more promising granite quarries may be mentioned those of Blue Mountain in Ryegate, the quarries in Barre, Craftsbury, Brownington, Newport, Kirby, Victory, and Brunswick. Preparations are now being made to quarry porphyry in St. Johnsbury, and Waterford.

During the two years here reported I have been conferred with by letter, or otherwise, in one hundred and sixty-three cases, in relation to supposed recent finds of minerals in Vermont. In most cases the amount was too small to be of value, but in some the ore was good, and appears to be in sufficient quantity, and quality, to warrant further examination and development. This will in most cases doubtless be made as soon as the revival of business and prices of metals favor the outlay. An extensive bed of iron ore (Magnetite) in Concord gives great promise.

There are, at present, enquiries by several parties for white silicious earth, and as there may be various deposits unopened in the State, I would suggest that parties owning such send me samples; and if of good quality, I may be able to put them in communication with purchasers.

ADDITIONS TO THE CABINET.

We have been enabled to make the usual increase in our specimens. Many of them have been through the courtesy of friends, and we are still indebted to the various railroads, not only in the State, but elsewhere, for their aid in bringing those collections together. It would give us pleasure to be more personal in our thanks, and give the names of all rendering aid in this collection, but it is hardly possible.

MINERALOGY.

In this department we have received various specimens from different localities in the State, and to aid in the collection of Vermont specimens I have purchased some beautiful geodes from Illinois, which I will give in exchange for any Vermont specimens desired. It is often that, in the homes of our citizens, I find a specimen or two that should be in our State collection; but they are unwilling to part with them, as they are kept for their beauty. I shall now be enabled to exchange, giving specimens foreign to Vermont, and more beautiful to grace our homes, for specimens desired in the State collection.

ORNITHOLOGY.

The following are the names of the birds, in part, that have been added, or in other words are the specimens added in 1875. Those of 1876 are not yet in order for names, and as no full list can be given, I give none of this year's acquisition.

No. Specimens.	COMMON NAMES.	SCIENTIFIC NAMES.	AUTHORITY
1	Bunting, Snow	Emberiza nivalis,	Linn.
2	" Towhe	Fringilla,	Gm.
1	Bittern, Least	Ardea exilis,	"
1	Bobolink,	Emberiza oryzivora,	Linn.
1	Cuckoo,	Coccygus Americanus,	Linn.
1	Duck, Oldwife	Anas glacialis,	Wilson.
1	" Velvet	" fusca,	Wilson.
1	" Ruddy	Erismatura rubida,	Bona.
2	" Barrows' Golden eye	Bucephala Islandica,	Baird.
1	Eagle, Bald	Falco leucocephalus,	Linn.
1	" Osprey	" haliaetus,	Linn.
1	Godwit, Hudsonian	Limosa Hudsonica,	Swainson.
1	Hawk, Pigeon	Falco columbarius,	Linn.
2	Kinglet, Golden	Regulus satrapa,	Coues.
1	Martin, Purple	Hirundo purpuria,	Linn.
1	Meganser, Red-breasted	Mergus serrator,	Linn.
1	Nuthatch, Redbellied	Sitta Canadensis,	Linn.
1	Owl, Acadian	Strix passerina,	Linn.
2	" Great horned	" Virginiana,	Gm.

No Specimens.	COMMON NAMES.	SCIENTIFIC NAMES.	AUTHORITY
1	Pewee,	Muscicapa nunciola,	Wilson.
1	“ Wood	“ virens,	Linn.
2	Plover, Piping	Charadrius hiaticula.	Wilson.
1	“ Ringneck	Acgialitis semipalmatus,	Coues.
2	Redpoll, Yellow	Fringilla linaria,	Linn.
2	“ Lesser	“	
1	Rail, Carolina	Porzano Carolina,	Saml.
1	Sparrow, Java	Fringilla,	Linn.
1	Sandpiper, Solitary	Fringa solitaria,	Wilson.
1	“ Spotted	“ macularia,	Wilson.
1	Teal, Green-winged	Anas crecca,	Wilson.
1	Tern, Least	Sterna minuta,	Wilson.
1	Thrush, Wilson's	Turdus mustelinus,	Wilson.
1	“ Wood	“	
1	“ Golden crowned	Motacilla aurocapilla,	Linn.
1	Vires, Yellow-throated	Muscicapa sylvicola,	Wilson.
1	Warbler, Black and yellow	Sylvia magnolia,	Wilson.
1	“ Yellow	Motacilla petechia,	Linn.
1	“ Cape May	Sylvia maritima,	Wilson.
1	Yellow Bird,	Fringilla tristis,	Linn.

We still desire specimens of rare birds killed in Vermont, and wish such when killed sent to us immediately by express. As there is an appropriation to pay express charges, such charges need not be prepaid. Should it be the desire of parties donating the birds that their names should appear on the specimens, a letter stating that fact, with name and residence, must be sent by mail. If birds are caught in traps, do not send them alive, as their plumage will be spoiled, but kill by pouring a spoonful of chloroform down their throats, and then wrap up in a paper before boxing, so as to retain their feathers in the most natural position.

*OOLOGY.

Though we have much increased our collection of eggs, more are wanted, and we should be glad to make arrangements for the same in different parts of the State. As soon as possible they will be mounted on the stands with the birds, and we hope soon to show the egg of every species, as well as the nests.

Nothing forms a more attractive feature in a museum, or is more acceptable to amateurs, than the nests and eggs of birds. These should be collected whenever they are met with, and in any number procurable for each species, as they are always in demand for purposes of exchange. Dozens of eggs of *any* species with their nests (or without, when not to be had) will be gladly received.

Nests require little preparation beyond packing so as to be secure from crumbling or injury. Each one should be placed in a box or ring of paper just large enough to hold it. The eggs of each nest, when emptied, may be replaced in it and the remaining space filled with cotton.

Eggs, when fresh, and before the chick has formed, may be emptied by making small pin-holes on opposite sides, and then blowing or sucking out the contents. Should hatching have already commenced, an aperture may be made in one side by carefully pricking with a fine needle round a small circle or ellipse, and thus cutting out a piece. The larger kinds should be washed inside, and all allowed to dry before packing away. If the egg be too small for the name, a number should be marked on it with ink corresponding to a memorandum list. Little precaution is required in packing, beyond arranging in layers with cotton and having the box entirely filled. It is always better to wrap each egg in a loose coat of cotton before arranging in layers, and they should be packed in small wooden boxes.

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* A pamphlet has been published by the Smithsonian Institution in regard to the collecting of nests and eggs, which may be obtained upon application.

Cracked eggs should have strips of tissue paper pasted over the line of fracture; or the crack may be painted over with collodion while the sides are pressed together.

CRANIOLOGY.

We now desire, to complete our set of Vermont mammals, the skull of the wolf, (Canis lupus,) and catamount, (Felis concolor). If any party will furnish them, we will make fair remuneration.

CONCHOLOGY.

I am glad to report an increase in the number of our shells, which will soon be arranged for exhibition. We have now nearly one hundred named species. We trust the friends of this specialty will not forget that they can send them nicely through the mail, and that we will exchange, giving specimens from other localities, as soon as we can get them named and in order for distribution.

ENTOMOLOGY.

In this department many additions have been made, and as there is much interest in relation to injurious insects at this time, I deem it best to answer in this report, in part at least, the numerous letters I receive; by a description of such of our insect enemies as I am so often enquired of in relation to; and notices of such means of destruction as are deemed best for their extermination. In a letter before me, I am asked: "What is science good for, if scientific men are baffled by one little insect which they cannot devise means to exterminate?"

Science is not baffled, but, like Hercules in the old fable of the wagoner, can help you, and will help you, only when you help yourselves. I may now hear you ask: "How we may help ourselves?" or how Vermont alone can help herself. We may safely calculate that the insect ravages in Vermont for the year 1877, will exceed three millions of dollars. Now is it too much to say that a concerted action on the part of all agriculturists would decrease this damage one half? Did science have full control of our legislature, law would require, and enforce, the necessary concert of action; and while agriculturists would groan under imaginary tyranny, they would reap the reward. As the agricultural interests control the legislature, ought they not and will they not take their best interests under consideration, and do something for themselves?

First, then: A law should be passed authorizing the selection, and providing for the payment, of a competent commission; perhaps of three persons, for this State; to be selected for their merit and ability for the work; not for political influence. This commission should sub-divide their work in such manner as to thoroughly investigate the habits, and times of appearance of agricultural pests; the effects upon them of all cheap materials which have been, or may be used as destroying agents; and to fully determine the proper times of applying the same. The members of this commission should have sufficient remuneration for time and labor, so that, if necessary, they could temporarily abandon other pursuits without damage to their pecuniary interests.

It is only by the association of several careful observers and investigators that the most useful results can be obtained.

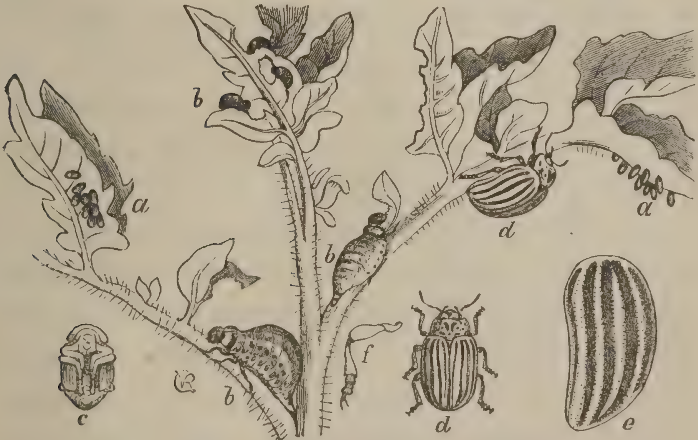
Secondly. When this information has been accumulated, it should, in compact form for easy reference, be widely published in newspapers, and in pamphlets, for a general distribution to all farmers.

Thirdly. When such information has been made general, compel by legislation, and impress the acts and the beneficial results of the same upon the community, through your agricultural societies, the Board of Agriculture, and the newspapers of the State. You already protect your birds by law, which is one step in the right direction. Can you, in fact, find an intelligent farmer in the State to-day, that would not cheerfully obey a judicious law to concertedly counteract the injury of the advancing potato bug? The rights of the intelligent who are disposed to help themselves and each other, can only thus be protected against their indolent neighbor who allows his fields to be the nursery of insects of destructive tendency, which overrun surrounding farms to such an extent that no industry can protect against them.

This, then, allow me to say to the agriculturists of Vermont; that a successful campaign against your insect enemies can only be brought about by the demand of yourselves; and that legislative enactments must furnish the means and give the power of action. Further: It must also protect this concerted action from the thriftless ignoramus that don't care for himself or neighbors. The fact is, that the ravages of hostile insects represent a condition of war, and it is only by organization, and appropriate weapons, that they can be conquered. The proper subjects for consideration are the materials to be used, the best time to make the attack in force, and the weapons to be employed. It is entirely useless for us to fold our arms and exclaim: "It is the will of God!"

THE COLORADO POTATO BEETLE.

Doryphora decemlineata, Say.



a, a, eggs; b, b, larva in different stages of growth; c, the pupa; d, beetles; e, elytron magnified; f, leg magnified.

This pest is now really in our midst, and though not as yet in sufficient numbers to do much harm, its previous history ought to give us warning. The great interest felt on account of this intruder has been manifest by the countless bugs of all descriptions that I have received by mail this season, with the enquiry: "Whether it is a potato bug." Nine times out of ten I could say it was not; but the number of actual potato beetles has led me to the belief that there is hardly a town in the State that has not in it the dreaded pest; in small numbers, it is true, but yet if not immediately attended to, two seasons more will blight our crop of potatoes as elsewhere. That all may recognize this pest, I will give something of its appearance, history and habits.

This bug, so called, is, strictly speaking, a beetle, and is known to naturalists under the name of *Doryphora decemlineata.* Like other higher species of the Coleoptera, it passes through a complete metamorphosis, but, unlike many other beetles, it confines itself during its entire life to the same species of vegetation, and, unhappily, selects as its first choice the potato. This beetle, however, is not, like many of our pests, an importation, but an original native of the far West. Its name would indicate Colorado as its birthplace, but historical facts do not confirm it, as the bug committed severe depredations in Nebraska and Kansas before it was ever seen in Colorado, and the farmers there consider it of Eastern origin. It is, however, described by naturalists as a native of the Rocky Mountains, from whence it came as soon as the cultivation of the potato offered a stepping stone to civilized life. I am, however, from its history which I have traced back as far as possible, of opinion that, if it came from the Rocky Mountains, it came down the fertile valley of the Missouri, or some of its branches, rather than across the desert of near five hundred miles intervening between the cultivated lands of Colorado, and the fertile plains of Kansas; and it is quite as likely that it had its origin in some of the fertile valleys or grassy plains of Nebraska.

That its native place is far west of the Mississippi no one can doubt. That it is a great lover of the potato plant is equally certain; yet it can exist upon other food when potatoes fail, but first selects the tomato and other plants nearly allied in properties to the potato leaf; but such plants are seldom attacked until the potato fields are fully devastated. The eggs of this beetle are deposited, to the number of seven or eight hundred, by each female, at intervals during from twenty-five to forty-five days, on the leaves of the potato, in regularly arranged clusters of from twenty to thirty eggs each. They are of an orange color, and always on the under side of the leaf. In about one week after they are deposited they hatch into larvæ, which feed upon the foliage about two weeks, though some fix the period at seventeen days. Their growth is quite regular, and when full grown they are three-eighths of an inch in length. Upon their sides they have two rows of slight protuberances tipped with black, ten in the lower row and nine in the upper; when full grown there is a faint trace of a third row below the two, and four black dots, forming the back of the neck, or thorax as it is more properly called in the insect. Its head is also black, and it has a black ring round its thorax. It has six legs, the first pair coming out of the thorax, and the others immediately behind, or on the front part of the abdomen. Its body is cream color. When full grown they descend to the ground, where they change into a pupa state near the surface. The perfect beetle appears in a little less than two weeks, pairs when about one week old, and a week later commences the deposits of eggs, as before described. From three to four broods will be hatched in a season. The statements of time are, however, liable to vary, being longer or shorter, according as the weather is more or less favorable to their development.

The mature beetle, as its name indicates, has ten lines of black lengthwise of its wing covers, five on each side, the ground being a medium yellow. It has several black spots upon its head and thorax, also six legs, and pink gauze wings under the striped wing covers described. It passes the winter in the perfect beetle state, burrowing in the ground beneath the frost, coming out unimpregnated in the spring, just in season to lay its eggs on the young potato plant.

Bad as these beetles are, they are not so bad as popular opinion makes them. Their first onset is the most severe, and farmers accustomed to give up to imaginary evils will talk about the extermination of the potato. Of that there is no danger from this cause. In Iowa, in 1870, the beetles were very abundant, so much so that they swarmed over barns and outhouses, and also entered dwellings so that you could hardly sit down or walk without crushing them, yet the crop of potatoes was the largest ever known, and they were retailed in the streets for twenty-five cents per bushel. This abundant crop was raised by every one planting in anticipation of high prices, thus bringing the opposite result.

By some this beetle is considered poisonous, but from no just cause, as it can be picked from the potatoes day after day, by whole families, with no bad result. Large quantities of them in the state of putrefaction, like all other animal matter, is disagreeable, and, doubtless, unhealthy, and they should never be left to putrefy, but be burned or destroyed with boiling water, and then buried. As they are voracious feeders, they may be killed with poison, like arsenic or Paris green, mixed with flour, and dusted on the potato leaves. As these substances are very poisonous if swallowed or inhaled, great care should be taken in their use.

As regards their depredations in the New England States, of course we have much to fear, and yet we have some things in our favor. First, its natural enemies. The "lady bird," which, perhaps, is more generally known as the lady bug, has been very abundant this season, causing the destruction of myriads of plant lice, and they need but encouragement to assist the farmer in the destruction of the potato beetle, as they are a deadly enemy. The eggs of the "lady birds" are very much like those of the potato beetle in color, but are smaller and not so many in a cluster, but always laid in close proximity to those of some other insect. As soon as they hatch, they commence their war of extermination, and, as they are voracious feeders, they follow it up almost unceasingly. This lady bug is about two-thirds the size of the potato beetle when fully grown, of a yellowish red color, with two or more black markings on each wing cover, being shorter and more thick-set than the potato beetle. In fine, they are about the size and shape of a half pea. There are several varieties, but all are the friends of the farmer, and should have special protection. The spined soldier bug and the banded robber bug also prey upon the larvæ of the potato beetle, as well as at least six other cannibal foes common to New England, although those enumerated are the most important.

Secondly. Our winters are more severe than the winters West. Jack Frost creeps deeper into the ground, and must overtake many of the ten liners that supposed themselves safe from cold. This year brings skirmishing parties into our midst, and in two years it is probable the main army will test our potatoes and our climate, so let us be ready to give them a *warm*, if not a welcome reception.

The material used in the warfare against this intruder has generally been Paris green dusted on the leaves when wet with dew, while the beetles are in their larval state, or mixed with water at the rate of one tablespoonful of the green to a pailful of water. When applied dry it is better to mix with ten parts of flour; and great care should be taken not to inhale the dust, as it is very poisonous. When in solution it must be almost continually stirred, or the green will sink to the bottom of the sprinkler, as it is not soluble in the water.

C. V. Riley, of Missouri, says that quite as good results may be obtained in using the ingredients from which green is made, as from the finished article. The Paris green costs say 37½ cents per pound, and the demand is often so great that it cannot be obtained just when wanted, especially in back towns. The following directions for making green, from Brande's Chemistry, are practical: Dissolve two pounds of sulphate of copper (blue vitriol, costing fifteen cents per pound, or thirty cents,) in a gallon of hot water, keeping it in a stone jar. Dissolve in another large jar, one pound of common white arsenic (costing about six cents,) and two pounds of saleratus or pearlash, (cost sixteen cents,) in forty-four pounds of hot water, stirring well till thoroughly dissolved. These articles, costing fifty-two cents, will make about five pounds of Paris green, costing about $1.88.

This can be kept in solution and mixed in proportion of one part of the first and five of the last solution, as they are needed. The green immediately begins to precipitate in a fine powder, and is much more convenient for use in solution than the dry article. Prof. Riley says that Paris green can be in this way used without danger, and all agree that in solution or mixed with flour when dry and dusted on it is the unfailing remedy.

Dr. Le Conte advises the use of large atomizers for not only the destruction of the potato beetle, but of all insects that can be killed by a solution. This idea is worthy of consideration, and it may, doubtless, prove invaluable.

Next to the potato beetle in number of enquiries comes the

STRIPED SQUASH BEETLE.

Diabrothica vittata, Fabr.

This beetle appears on cucumber and squash vines, as soon as they are through the ground, and frequently devours them all in spite of the usual preventives used. They need little description, as they are well known by the yellowish stripes upon each wing cover. They lay their eggs in June, or soon after their appearance, and the larva arrives at maturity in about a month after the egg is laid. The larva remains in the pupa state about two weeks. We usually have but two generations in a season. It remains through the winter in the pupa state. The grub often hollows out the stem of the squash or cucumber vine, below the ground, the last of June or first of July, and sometimes eats the upper portion of the root. Should this food get short they may be found in the stem above ground. They, however, do not do great damage either in the second generation, or in their grub life. Covering the vines with a box covered on top with muslin, has been considered the only sure remedy; though powdered charcoal, lime, and sometimes ashes, can be used with benefit. In many cases, however, the material sprinkled on the leaf is as bad as the beetle. If a handful of shavings be burned near the hills in the evening, many of them will fly into the flames. After various experiments, I have become satisfied that covering the hills with common newspapers, is much the best means to be used; besides, you get an accelerated growth of the plants. Just as soon as they break ground, or, perhaps better, a day or two before the plants appear, open a newspaper to its full size, and spread it over the hill, letting it lie close on the ground, and fasten it in place by hoeing the dirt on to the edges, so that no gusts of wind can disturb them. The plants thus covered will grow at least a third faster than those not covered, are safe from the beetles, and more healthy in every way, producing blossoms several days sooner than those not covered. It is seldom that once covering will not answer all purposes, but should one be torn off from any cause, it can easily be replaced. I have tried different colors of paper, and find white or blue paper best adapted to the purpose. Other colors seem to give a paler green or sickly appearance to the plants. Newspapers are easily obtained, and are just as good as clear white paper. It will be seen, also, that this is a protection against late frost, and I believe that every person that tries this method of protection will ever use it with entire satisfaction.

THE TENT CATERPILLAR.

Clisiocampa Americana, Harris.

This caterpillar is well known to all, yet all do not understand its habits. The eggs are laid by a night flying moth, in August, or in the southern part of the State, doubtless, in the last part of July, in oval rings, round the smaller twigs. These egg rings contain some three hundred eggs each, and are covered over with a mucilaginous coating which answers the double purpose of keeping out the water, and food for the young when they hatch, to give them sufficient strength to crawl down the limb to the first fork, where, by crawling back and forth, they weave from a spinneret in their mouth, the tent in which they live. From this tent they sally forth twice a day for food, eating voraciously. On an average, each caterpillar will eat two apple leaves a day, and no tree can long live under such a vital drain. As the weather gets warm, when they return from a meal, instead of going into their tent, they will go to rest upon the outside. Those coming in later and finding no room, will crawl over the sleepers, spinning all the time until they are covered, and another story is added to their tent. Thus from time to time it is increased with their growth until their food gives out, or their caterpillar life is spent, when they lose their social habits, and wander off to find other food, which they are seldom able to do, or find suitable places in which to spin their cocoons. These are light colored, with a tinge of yellow, and may generally be found attached horizontally, to the under side of fence rails, or other protected places. They remain in these about three weeks, when such as have not fallen a prey to the ichneumon fly, as many do, come forth to lay their eggs, as before described. The question so often asked is: "How to destroy them?" I will first tell you how you ought not. Some flash gunpowder on their nests; others burn them with a torch; while some put on kerosene and burn, and others saturate with oil, to kill them. All these methods are destructive to the trees, and should never be employed. Upon a moment's reflection it will be seen that the quickest and easiest way is to cut off the twig containing the eggs. After the leaves have fallen, on a frosty morning, the eggs may be readily seen as a dark band on the twigs, as the frost does not so readily adhere to them. When you cut them off always burn them. If this method is neglected, watch your trees when they first hatch, and with a stick remove the entire nest early in the morning, or just at night, as they feed and are consequently scattered over the branches both in the middle of the forenoon and middle of the afternoon, and some stragglers are absent all day. If they are still neglected, as they should not be, there is no sure way to rid your trees of them but to put on gloves and clean them off with your hands. You can kill by crushing, or have an attendant with a pail of hot water, and put in such branches as you can cut away, or do not crush. Every tent found, whether on orchard or forest tree, should be destroyed.

Nearly akin to this insect is

THE FOREST TENT CATERPILLAR.

Clisiocampa sylvatica, Harris.

This caterpillar, for some years past, has been destructive to forest trees as well as apple orchards, yet what I have previously said will equally well apply to this species, only its eggs which surround the twig in the same manner, form a complete cylinder, holding its full size from one end to the other, uniform in diameter, and cut off squarely at each end, while the egg masses of the other are oval rings, rounded at each end of the mass. They are a more hardy species, and after having stripped one tree of its leaves, will travel in troops to another, ascend, and there make their home. This can easily be prevented by putting tar or printer's ink about the trunks of trees not infested. The habits of this insect are not the same as those of the other. While they spin a thread they do not form a tent between the branches, but, resting upon the smooth side of the trunk or branch, their thread lies between and beneath them, so it does not make much show. They feed night and morn, sometimes in the night, and are more voracious than the former. While the former appear almost every year, this species is seldom plenty but a year or two at a time. They will hardly be seen for three or four years, and then reappear in abundance as before.

The reason for this seems to be that their natural enemies increase more rapidly upon abundance, than they do, and, after overpowering them, almost die out also, and then the caterpillar gains ground again. The same means of killing should be employed as before.

Next to the caterpillar comes the

WEB WORM.

Hyphantria textor, Harris.

This is often supposed to be the second brood of the Tent caterpillar, but is a different species altogether. The last of July a small white moth lays her eggs upon the end leaf of a branch, which soon hatch. The young enclose the end of the branch in their web, feeding only upon the pulpy parts of the leaf, leaving the skeleton behind. They extend the web over other leaves as soon as they are needed for food. When fully grown, they descend the tree, and pass the winter in the pupa state in the ground.

The best way to rid your trees of this pest, is to clip off the end of the branch as soon as the worm appears. On no account delay, as if you do, they will slip through your fingers, and much increase your labors the next season. If they are neglected until they cover more than you desire to prune away, kill as you do the Tent caterpillar. This you can do at any time, as they never leave their tent as the others do, but extend it as they desire more food.

THE CURRANT WORM.

Nematus ventricosus, Klug.

This, like the caterpillar, needs no description, as it may be found in its season upon currant and gooseberry bushes, in all parts of the State.

The perfected insect lays its eggs on the under side of the leaves, generally beside the veins, but sometimes in clusters. In from six to eight days, according to the weather, they hatch, and commence feeding. They continue their work upon the bushes, until they are bare of leaves, and then, whether fully grown or not, go down into the ground and form little black pupæ, varying in size according to the way the worm is fed. Emerging in about two weeks, they lay their second brood, which pass the pupa state in the ground as before, but do not emerge until the following spring. Powdered white hellebore is, perhaps, generally used for their destruction, but is no better than any other dust. Any dust that touches them is lodged in their spiracles, or breathing-pores, and soon produces death. Dust from the road, dried fine plaster of Paris, or any finely pulverized substance, will answer. The Grafton fertilizer, which was finely pulverized quartz, was the best material I ever saw for killing them. It possessed the requisites of great fineness and perfect dryness, so it would make a dust easily. The hellebore is an excellent preparation for the purpose, but might poison the fruit. Gum aloes is, when fine, equally penetrating, and less dangerous.

CABBAGE WORM.

Pieris rapœ.

Twenty years ago this centennial year, this obnoxious European insect landed in Quebec, and from that beginning has made itself familiar with not only New England, but most of the United States, as well as Canada.

It is susceptible to the dust treatment, but as that gets into the cabbage head and injures it, it cannot be used to advantage. There is, however, a little parasite, *Pteromalus puparum*, *Linn.*, which deposits its eggs in the pupa of the cabbage butterfly, and the young find food enough to develop forty or fifty from one pupa, to again feed upon this obnoxious insect. This parasite is not found in all places where the cabbage worm is, as they are not so rapid travelers, but, doubtless, soon they will be held in check by this little friend of mankind.

THE CODLING MOTH OR APPLE WORM.

Carpocapsa pomonella, *Linn.*

This is another imported insect, but is, doubtless, found everywhere where apples are raised, and so has become domesticated in its American home. About the first of July, in this State, the night flying moth comes from his silken cocoon, which was hid under some bit of bark, or sliver on the fence near by. After pairing the male dies, but the female may be seen in the dusk of night flitting around the apple tree, laying her eggs in the blossom end of the little apples.

In about a week the egg hatches, and the worm eats his way into the apple, where it lives for about a month, when it bores its way out through the side, and escapes to some sheltered place, where it builds its cocoon, as stated; but this time coming out in about twelve days, laying eggs as before, this brood giving us the wormy apples in the fall. What worms survive build cocoons as before, to come out perfected the next summer. The first brood is very small, but the second is fifty to one of the first, or even more.

Our protection against this insect is very difficult, and so most people do nothing. Putting wisps of straw round the tree, to furnish shelter for cocoons, and then taking off an burning, or scalding it; removing all rubbish from near the trees, which could afford shelter; allowing cattle or pigs to run in the orchard to pick up the fallen fruit, and many other things are devised, but all fail in keeping them only temporarily in check. It is a great task to do all this, but in the spring the destruction of one cocoon, and many may often be found where apples have been kept through the winter, saves at least one hundred apples from contamination. It will be seen that their destruction is of great importance.

THE APPLE TREE BORER.

Saperda bivitata, Say.

This is a native American, born and bred in the mountains, feeding upon the wild crab, mountain ash, and various other trees. It comes out of the trunk, usually in June, and always in the night, in its perfect state. Resting by day, in the night time it flies from tree to tree for food and companions. Though they feed upon the bark of branches where it is tender and succulent, they lay their eggs on the bark at the foot of the tree, where the young, as soon as hatched, commence to burrow in the bark. For the first year they live mostly in the bark, but, towards the last of the season, advance into the sap wood. Frequently in young trees the bark over them will crack and allow their castings to fall out, and thus they may be detected. They remain in the tree three years. As the time comes for their exit, they eat their way to the bark, thin that somewhat, and go into the pupa state, to emerge perfected in about four weeks.

The best remedy is to prevent the successful laying of eggs, which may be done by smoothing and then soaping the bark. If such is done near the ground only, they will lay their eggs at the junction of the largest limbs, or higher up on the trunk, so the scraping and soaping wants to be thorough. If the borers are really in the trees, there is no way except to kill them, or cut them out one at a time. A small piece of whalebone is the best to kill them with, by pushing it into their hole. A piece of wire will answer. When the bark is killed over them it is just as well to cut them out. The application of the soap is necessary in May. Either soft or hard soap will do, but if hard soap is used a thin piece had better be crowded down into each principal crotch of the tree, so that the rain may wash it down the trunk. Do this, of course, after having washed the tree with strong suds.

Though many other insects have been enquired after, the foregoing are the principal ones. As in times past, I shall be willing to give, by letter, to the enquirer, such information in relation to insects as I may be able to impart, yet would advise that all study the habits of pests; and when they are enabled to fight one with success, let it be known through the press, that all may profit thereby.

Most respectfully yours,

HIRAM A. CUTTING, M. D.,

State Geologist and Curator State Cabinet.

Lunenburgh, Vt., August 31, 1876.

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